BC hydro

Electric Load Forecast
1991/92 - 2011/12

Prepared by Business Development

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EXECUTIVE SUMMARY

This document represents the first long-term (20-year) forecast prepared by B.C. Hydro since 1989. Electricity requirements are forecast through to 2011/12. Unless indicated otherwise, all numbers in the document correspond to the Probable forecast.

Total sales to B.C. Hydro service area are projected to increase from 40,333 GW·h in 1990/91 to 57,366 GW·h in 2011/12 for an average annual growth of 1.7%.

The probable forecast has total gross generation requirements increasing from 45,805 GW·h in 1990/91 to 68,037 GW·h in 2011/12 for an average annual growth of 1.9%. This represents an expansion of the present system by 48.5% over the 21-year period beginning 1990/91.

Integrated peak system demand is projected to increase from 8401 MW in 1990/91 to 11,981 MW in 2011/12, representing an average annual growth rate of 1.7%.

Residential sales are projected to increase from 11,783 GW·h in 1990/91 to 14,870 GW·h in 2011/12 for an average annual growth rate of 1.1%. This is less than the forecast annual growth rate for the provincial population over the same period of 1.7% because of a combination of demographic factors and increased efficiency of electricity use.

Commercial sector sales are forecast to increase from 10,588 GW·h in 1990/91 to 17,116 GW·h by 2011/12, representing an average annual growth rate of 2.3%. The commercial sector's share of total domestic electricity sales will increase from about 25.9% at present to 28.6% by 2011/12. Commercial sales are forecast to increase in response to a growing provincial population, and tÁo continued increase in the use of electronic and information technology and ongoing growth in service-based industries.

Industrial sector sales are projected to increase from 17,962 GW·h in 1990/91 to 25,380 GW·h by 2011/12 for an average growth rate of 1.7% per year.

- B.C.'s pulp and paper industry will maintain its share of total industrial transmission sales of about 60%, continuing to be the chief driver of increases in industrial sales. The industry's pace of expansion will slow relative to historic patterns, but increases in electricity-intensive mechanical pulping and in value-added manufacturing will result in additional electricity demands.

- Expansion of B.C.'s wood manufacturing industry will be curtailed by fibre constraints; nonetheless, this industry's electricity demands will also increase as the result of additional value-added manufacturing.

- Decreases in electrochemical plant demands in the face of reduced demand for chlorine-based pulping chemicals will be offset over the long-term by increased manufacture of

alternative pulping chemicals and by some increase in petrochemical production. Consequently, the demands of the chemical industry are seen to remain constant over the forecast period.

- Some increase in demand is seen in the mining sector after 1995 with the opening of new mines. For the remainder of the forecast period, mining industry demands are expected to plateau; load reductions resulting from the closure of existing mines as reserves are depleted will be offset by the opening of new mines.

- Decreases in metallurgical coal demand by Pacific Rim steel producers will result in reduced sales to the coal mining industry for the remainder of this decade. Over the longer term, increased world demand for thermal coal will cause some resurgence in demands by B.C.'s coal mines.

- The remainder of the projected increase in industrial sales will be the result of growth in the amount of non-primary resource-based manufacturing facilities and in the number of smaller, diverse industries.

Probable Energy Forecast - 5 Year Interval

	Annual Sales to BCH Service Area	Average Annual Growth Using 1990/91 as Base Year	Integrated System Annual Gross Requirements	Average Annual Growth Using 1990/91 as Base Year	Integrated System Annual Peak Demand (MW)	
					Summer	Winter
	(GW·h)	(%)	(GW·h)	(%)		
1991/92	40,094	-0.6	48,116	5.4%	5,945	8,480
1996/97	45,323	2.0	52,289	2.3%	6,751	9,284
2001/02	49,882	2.0	58,132	2.2%	7,493	10,363
2006/07	53,701	1.8	63,267	2.1%	8,144	11,214
2011/12	57,366	1.7	67,792	1.9%	8,665	11,981

Economic Assumptions

Over the short term, the general economic outlook is one of cautious optimism. A gradual recovery from the recession is foreseen rather than a rapid rebound. Demand for B.C.'s exports are forecast to grow at a steady pace throughout the remainder of the decade. Constraints to high growth in B.C., Canada and other nations in general are: increasing competition from developing regions; a growing global demand for capital; pressure on all levels of government to practice sound financial management, including debt reduction and lessened borrowing; and continued high interest rates.

Growth rates for population, real GDP and the Consumer Price Index (CPI) for the period 1992-96 are forecast to be 2.0%, 2.3% and 3.5%, respectively. For the period 1996-2012, population is forecast to grow at 1.7%, real GDP at 2.2%, and the CPI at 4.0%.

The last long term forecast, which was prepared in 1989, forecast a decline in real electricity prices over the long term. This forecast, in contrast, predicts modest increases in electricity prices over the 21-year forecast period.

COMPARISON OF GROWTH RATES

	Population		Real GDP		Consumer Price Index		Electricity Price**	
Year	1991 Forecast	1989 Forecast	1991 Forecast	1989 Forecast	1991 Forecast	1989 Forecast	1991 Forecast	1989 Forecast
1988-1991	2.5%*	2.0%	3.4%*	3.2%	4.4%*	4.9%	-1.5%*	-1.5%
1991-1996	2.1%	1.6%	1.9%	2.9%	3.6%	4.4%	2.0%	-1.5%
1996-2001	1.8%	1.4%	2.2%	2.5%	4.0%	4.0%	0.0%	-0.6%
2001-2010	1.7%	1.3%	1.9%	2.1%	4.0%	4.1%	0.0%	0.0%

* Actual figures

** Electricity pricing assumption does not include GST in 1991 and any additional annual water rental fee increases

Sensitivity Analysis

To reflect the uncertainties implicit in the forecast, four major causal factors were used to analyze the sensitivity of the 1991 Probable forecast of sales to B.C. Hydro service area: GDP, inflation, DSM and price elasticity. An uncertainty model employing Monte Carlo simulation was used to quantify and combine the probability distributions, thereby reflecting the relationships between the four causal factors and electricity consumption.

Compared to the probable forecast, the result of the analysis indicates that:

- there is a 10% chance that sales to B.C. Hydro service area would be increased by a total of 17,697 GW·h at the end of the 21-year period;
- there is a 10% chance that sales to B.C. Hydro service area would be reduced by a total of 2,594 GW·h at the end of the 21-year period;
- expected sales to B.C. Hydro service area would be increased by a total of 7,048 GW·h at the end of the 21-year period.

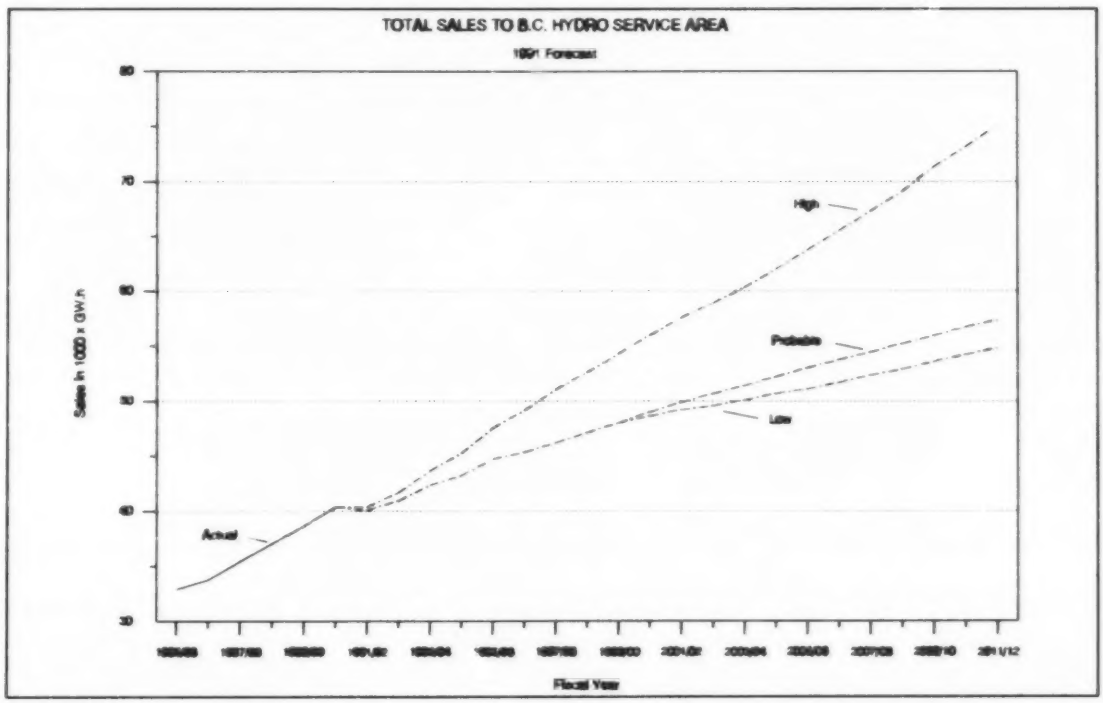
Power Smart

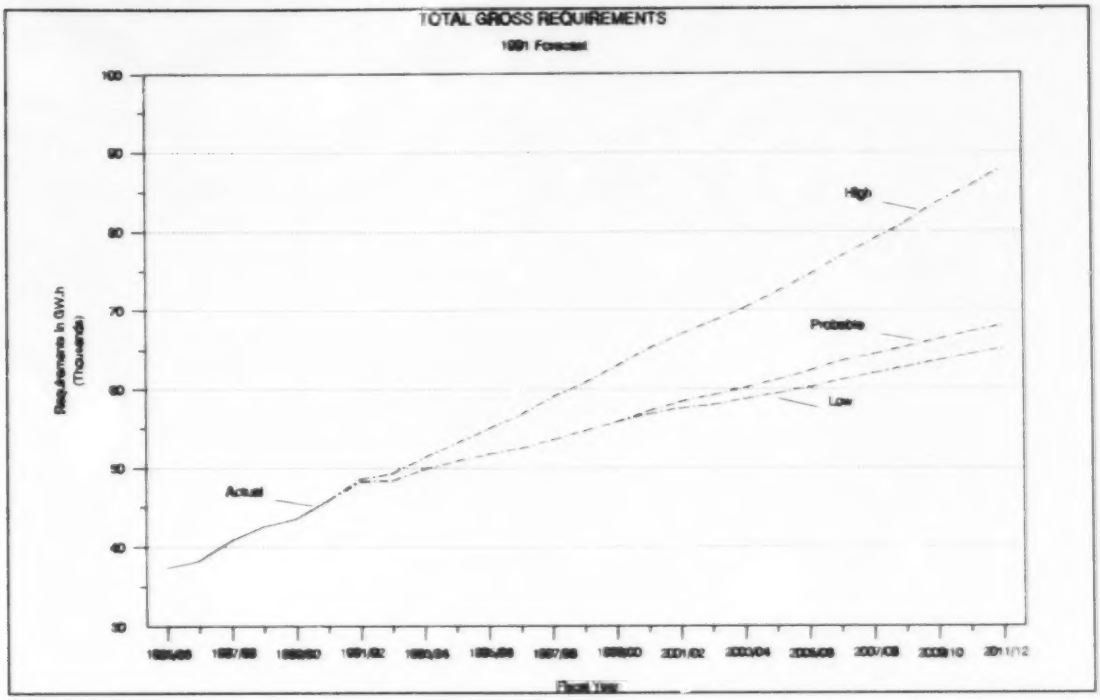
Power Smart programs are separated into two groups:

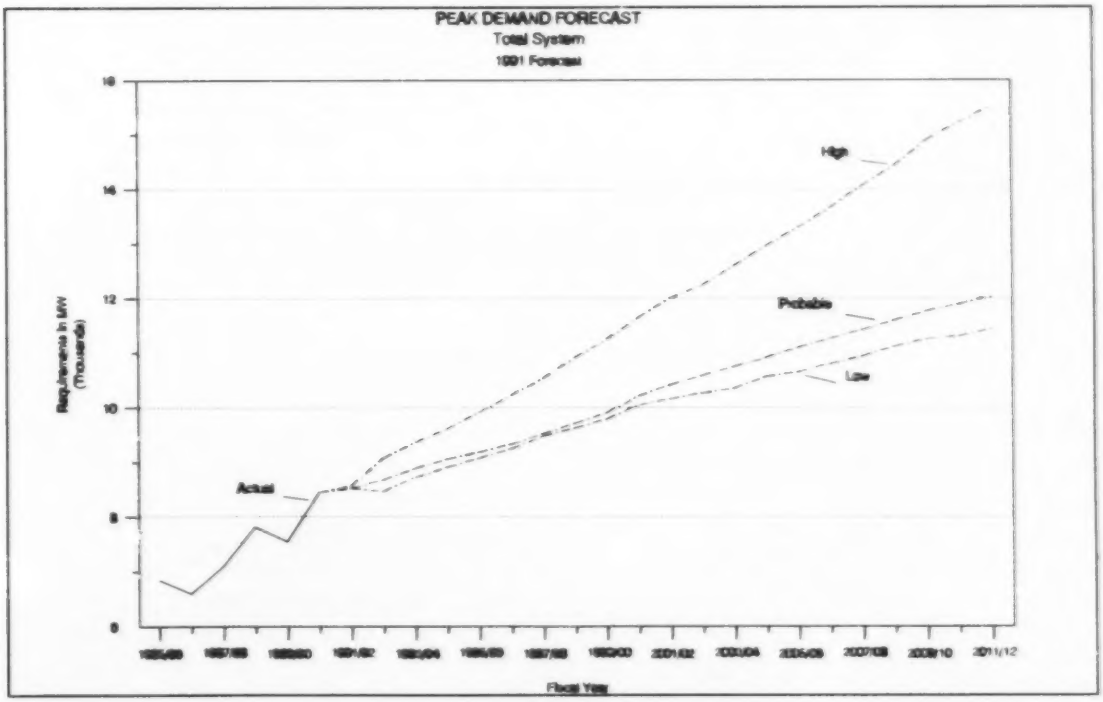
- programs already in operation are included on the demand side, and are reflected in changes in customer end use profiles in the forecasting models employed;

- programs not yet in operation and programs with identifiable impacts on a customer-by-customer basis remain as resources.

This change in methodology recognizes that uncertainties regarding behavioural response exist, and that Power Smart programs already in place will have some lasting impact on consumption patterns.




TOTAL GROSS REQUIREMENTS
1991 Forecast
Requirements in GW.h
(Thousands)
100
90
80
70
60
50
40
30
High
Probable
Low
Actual
1985/86
1987/88
1989/90
1991/92
1993/94
1995/96
1997/98
1999/00
2001/02
2003/04
2005/06
2007/08
2009/10
2011/12
Fiscal Year


PEAK DEMAND FORECAST
Total System
1991 Forecast
Requirements in MW
(Thousands)
16
14
12
10
8
High
Probable
Low
Actual
1985/86
1987/88
1989/90
1991/92
1993/94
1995/96
1997/98
1999/00
2001/02
2003/04
2005/06
2007/08
2009/10
2011/12
Fiscal Year

1991 ELECTRIC LOAD FORECAST

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SECTION 1.0 - INTRODUCTION

B.C. Hydro generates approximately 78% of the electricity consumed in the province of B.C. The remainder is generated by industry in self-generation facilities, by Alcan's hydroelectric facility near Kitimat, by West Kootenay Power and Cominco in the south-central portion of the province, and by a few small facilities outside of B.C. Hydro's grid. With more than 1.2 million direct customers in 1990/91, B.C. Hydro serves over 92% of the province's population. These customers are served by a system comprised of 10,466 MW of generation capacity, 90% of which is hydroelectric, and using over 67,000 km of transmission and distribution lines.

This report contains details on B.C. Hydro's 1991 forecast of gross electric requirements through to 2011/12. This is the first update of B.C. Hydro's long-term (next 20 years) load forecast since 1989.

Before 1989, long-term load forecasting was done annually with a load forecast report published each year. Since 1989, B.C. Hydro has been producing a short-term (next five years) forecast and a long-term load forecast on an alternate year basis.

The Probable Forecast section contains the economic forecast and the revised annual gross requirements, sales and peak demand. Details of assumptions used in preparing the probable sectoral forecast are included in the Residential Sales, Commercial Sales, Industrial Sales, and Other Sales sections.

The Forecast Process and Methodology section describes the approach used in developing the Probable Forecast, including the iterative process employed in evaluating the impact of the load forecast on other planning requirements, and assumptions of customer response to energy price changes.

The Energy Prices section outlines forecasts of electricity, light fuel oil, and natural gas prices.

The Sensitivity Analysis section explains the analysis of the uncertainty band around the probable energy and peak demand forecasts, provides a comparison of historical forecasts, and discusses weather sensitivity effects on peak demands. The importance of the uncertainty band for planning purposes must be emphasized. The Probable Forecast reflects the future most likely to occur; the uncertainty band reflects the sensitivity of the Probable Forecast to four major causal factors, GDP, inflation, price elasticity, and demand side management efforts.

The Marketing and Power Smart section discusses the present status of B.C. Hydro's demand side management programs and the method used to incorporate them into the load forecast.

The Appendices include detailed tables of energy and peak forecasts to 2011/12, details on inputs to the forecast, information on the methodology used to produce the uncertainty band, and a listing of B.C. Hydro's Power Smart programs.

SECTION 2.0 - PROBABLE FORECAST

2.1 ECONOMIC FORECAST

(a) A Review of Events Between 1989 and 1991

Canada has been experiencing an economic downturn since the middle of 1990. B.C. has been affected by the recession, but to a lesser extent. This economic downturn has, however, impacted B.C. Hydro's electricity sales. Total sales to the end of the 1990/91 fiscal year (12 months to March 1991) were 4.73% over the 1989/90 fiscal year (12 months to March 1990), but were 0.37% below forecast. Economic indicators suggested that B.C. has escaped the worst of the national recession because:

(i) In-migration into B.C. from other provinces and from abroad has remained high. In 1990, 40,990 people moved into the province from other parts of Canada and 23,500 from abroad. Together with a 21,500 natural increase, the total population growth for 1990 was about 86,000. These trends continued in 1991. Between January and June 1991, the total estimated population increase was about 33,500. This population growth has resulted in more electricity sales to the residential sector.

(ii) More commercial activities were generated to support a larger population, continuing a trend in B.C. towards a more service-based economy. Business has also been pursuing productivity improvements with increased use of electricity-intensive equipment in office automation and personal computing. Tourism and health care related business activities continue to increase. While Vancouver is continuing to grow as an international finance centre, B.C. overall is acting as Canada's link with the fast-growing Far East market. These factors have resulted in increased electricity sales to the commercial sector.

(iii) Demand for B.C.'s resource-based products has declined because of worsening global economic conditions. Twelve-month industrial sales from October 1990 to September 1991 were 2.2% below sales for the previous 12 months. Sales reductions due to poor markets have been partly offset by the addition of electricity-intensive pollution control equipment in the pulp and paper industry, by increases in value-added production by forest resources companies, and by the start-up of some new, non-resource based manufacturing facilities.

(b) General Economic Outlook

(i) In the short-term, the general economic outlook could be described as "cautiously optimistic". Business indicators suggested that the recovery from the 1990 recession is going to be slow because of structual changes prompted by domestic and international political issues, the formation of international trade blocs, and the general economic climate. A gradual recovery in the global economy is expected to begin in 1992, and an increasing demand for electricity will result as demand for B.C.'s exports improves. In particular, B.C.'s pulp and paper producers increased their production capacity by an estimated 20% in the period 1987-1990. Mills with recently added production capacity are still in the process of building up their load to full operating rates as the economy recovers. That implies increased electricity demand in the short-term despite a lack of any additional production capacity.

(ii) In the long-term, demand for B.C.'s exports are forecast to grow at a steady pace through the balance of the 1990s because of continued reductions of world trade barriers; a continued growth in international trade as a result of the relatively stable economic conditions; a steadily declining real price of commodities as a result of improved technology and lower production costs; and an increasing demand for B.C.'s commodity exports from the fast growing Far East region.

(iii) Factors limiting high economic growth in B.C., Canada and other developed countries in general are: increasing competition from developing regions; a growing global demand for capital; pressure on all levels of government to practise sound financial management, including reducing existing debts and borrowing; and a continued high interest rates financial environment. The rapidly growing international preoccupation with environmental issues implies increasing demands on resource-based industries to manage their natural resources and to invest in pollution control measures.

(c) Population Forecast

(i) Interprovincial migration into B.C. is expected to remain high in the short-term, mainly because economic conditions in B.C. are better than elsewhere in Canada. Interprovincial migration reflects increased employment opportunities in B.C.; retirees' preferences to settle in a milder climate; and a preference by many Canadians for the West Coast lifestyle. However, in-migration into the province will be reduced over the longer term, mainly because the overall population growth for Canada is expected to decline.

(ii) In recent years, 12% to 14% of all immigrants to Canada have settled in B.C. International migration is expected to decrease in the long-term because of continuous improvement in global political and economic conditions. The forecast for 1996 to 2012 adopts the assumption that immigration to Canada will remain at the 250,000 level throughout the forecast period, as proposed in the October 1990 Annual Report to Parliament on Future Immigration Levels.

(d) Probable Economic Forecast

GROWTH RATES (%)

Year	Population	Real GDP	Consumer Price Index
1992	2.2	3.0	3.0
1992-1996	2.0	2.3	3.5
1996-2011	1.7	2.2	4.0

(e) Energy Prices

(i) Electricity Price

Electricity price is projected to increase slightly in real terms over the next four years and to remain flat in real terms thereafter. In addition to electricity price, provincial government water rental levies must also be considered. "Real Term" implies net of the Consumer Price Index, i.e. net of inflation.

(ii) Light Fuel Oil (LFO) Prices

Crude oil prices are projected to increase marginally in real terms, reaching U.S. $25 (1990 $) per barrel in 2010. Refinery and distribution margins are projected to decrease in real terms. The combined effect is a projection for LFO prices increasing only marginally in real terms through 2010.

(iii) Natural Gas Prices

Natural gas prices (average across all sectors) are currently composed of approximately 37% wellhead prices and 63% gathering, processing, transportation and distribution costs. With gradual dissolving of the "gas bubble", wellhead prices, in real terms, are projected to begin rising by the mid-1990s, and to be 85% over 1990 prices by 2010. Gathering, processing, transportation and distribution costs are all projected to

decrease, in real terms, through the period. Combining the two costs results in average natural gas (burner tip) prices in 2010 projected at 14% over 1990 prices.

(iv) Probable Energy Price Forecast for the Residential Sector

Year	Electricity (1990 ¢/kW·h)	Light Fuel Oil[1] (1990 $/GJ)	Natural Gas[1] (1990 $/GJ)
1990 (actual)	5.684	9.50[2,4]	4.69
1995[3]	6.871	9.33	5.05
2000[3]	7.045	9.48	5.33
2010[3]	7.405	9.62	5.78

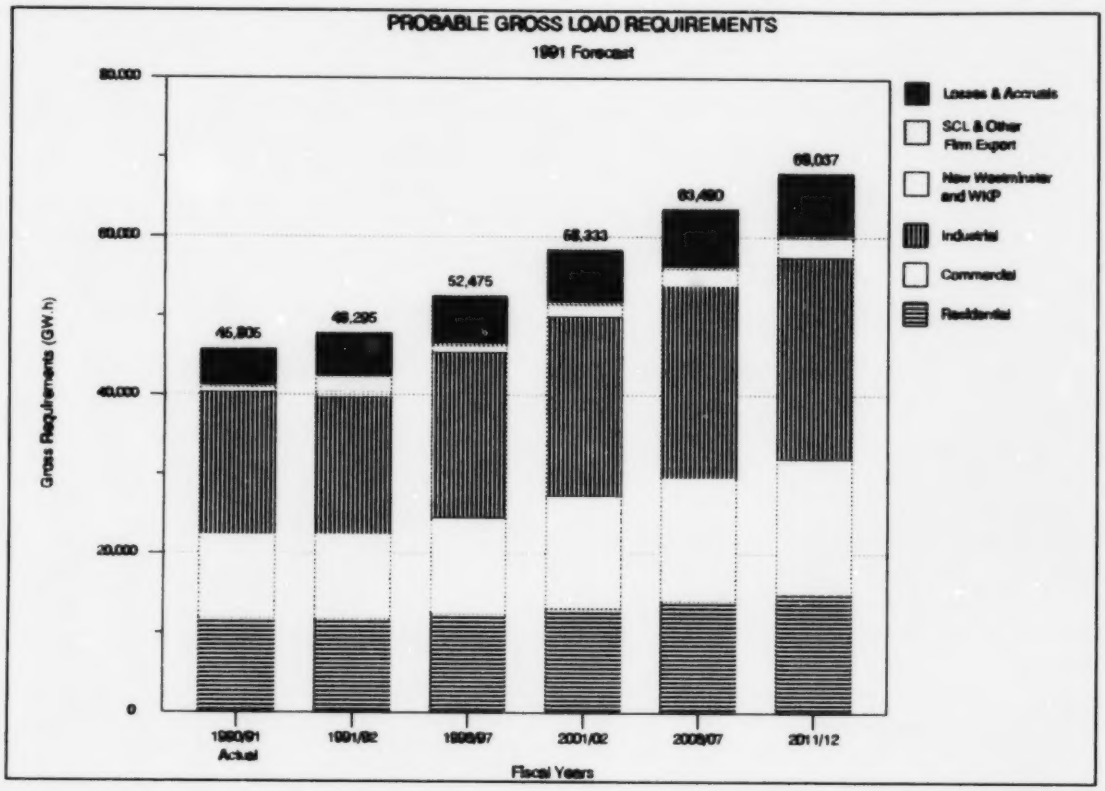
1 Burner tip prices, not corrected for efficiency.
2 Vancouver price.
3 Includes 7% for GST (after 1990).
4 1990 LFO prices were high due to Gulf War influence on crude oil prices.

2.2 ENERGY REQUIREMENTS

(a) Energy

The probable electricity forecast includes energy requirements for B.C. Hydro's integrated and non-integrated service areas, plus domestic inter-utility and firm export commitments. Interruptible export sales are not included.

Domestic inter-utility commitments include sales nominations from West Kootenay Power (WKP) and expected sales to the City of New Westminster. Firm exports include sales to Seattle City Light (SCL); Puget Power; Hyder, Alaska; Alberta Power; Bonneville Power Administration (BPA); and other southern U.S. utilities.



(b) Gross Requirements

Total gross generation requirements are obtained by adding losses to sales estimates. Losses are based on historic differences between gross generation and sales data.

Total gross generation requirements are projected to increase from 45,805 GW·h in 1990/91 to 68,037 GW·h in 2011/12 for an average annual growth of 1.9%. Growth is expected to be highest in the first five years of the forecast, with slower growth in the last 10 years. This represents an expansion of the present system by 48.5% over the next 21 years.

Energy losses are calculated in two steps. First, distribution losses are calculated as 6.9% of distribution sales. Distribution sales include all customers not served directly at transmission voltage (60 kV or above). Second, transmission losses are calculated as 8.3% of the total of distribution sales, distribution losses, and transmission sales. The overall result is that total losses are approximately 13% of total sales.

West Kootenay Power and Seattle City Light gross generation requirements are calculated separately.

(c) Capacity

Total system capacity is projected to increase from a system peak of 8,440 MW in 1990/91 to 12,031 MW in 2011/12 for an average annual growth rate of 1.7%. This represents an increase of 42.5% in capacity over 21 years.

(d) Total Firm Sales

Total firm sales are projected to increase from 41,266 GW·h in 1990/91 to 60,286 GW·h in 2011/12 for a 21-year average annual growth rate of 1.8%.

(e) Total Sales to B.C. Hydro Service Area

Total annual B.C. Hydro service area sales to residential, commercial, and industrial customers are projected to increase by 17,033 GW·h by 2011/12 for an average annual growth rate of 1.7%. The residential sector accounts for 3,087 GW·h of the increase, the commercial sector accounts for 6,528 GW·h, and the industrial sector accounts for 7,418 GW·h.

(f) Total Domestic Inter-Utility Sales and Firm Export Sales

Domestic inter-utility sales are forecast to increase by 1,959 GW·h for an average annual growth rate of 7.1% over 21 years. Firm export sales are forecast to increase by 28 GW·h over the 1990/91 level for an average annual growth rate of 0.4% over 21 years.

See Appendix F for a comparison of the 1990 and 1991 sales forecasts.

2.3 RESIDENTIAL SALES

Residential sales are projected to increase from 11,783 GW·h in 1990/91 to 14,870 GW·h in 2011/12 for an average annual growth rate of 1.1%. The two main drivers of residential sales are population growth and use rate (kW.h per account).

Assumptions for the residential forecast are that the number of accounts will steadily increase, but that use rate will begin to gradually decline. The net result is that residential sales will continue to grow, but at a lower rate than population growth.

The rate of increase in annual residential use rate has been declining since 1985/86.

When residential sales were normalized (adjusted for weather effects), the 1990/91 annual use rate was 10,435 kW.h per account. The year before, use rate was 10,283 kW.h per account, indicating a one-year increase in use per account of 152 kW.h.

In 1985/86, use rate was 9,315 kW.h per account, and in 1988/87, use rate was 9,667 kW.h per account. Thus, four years ago, the use rate per account was increasing by about 350 kW.h per year, more than twice the present rate of increase.

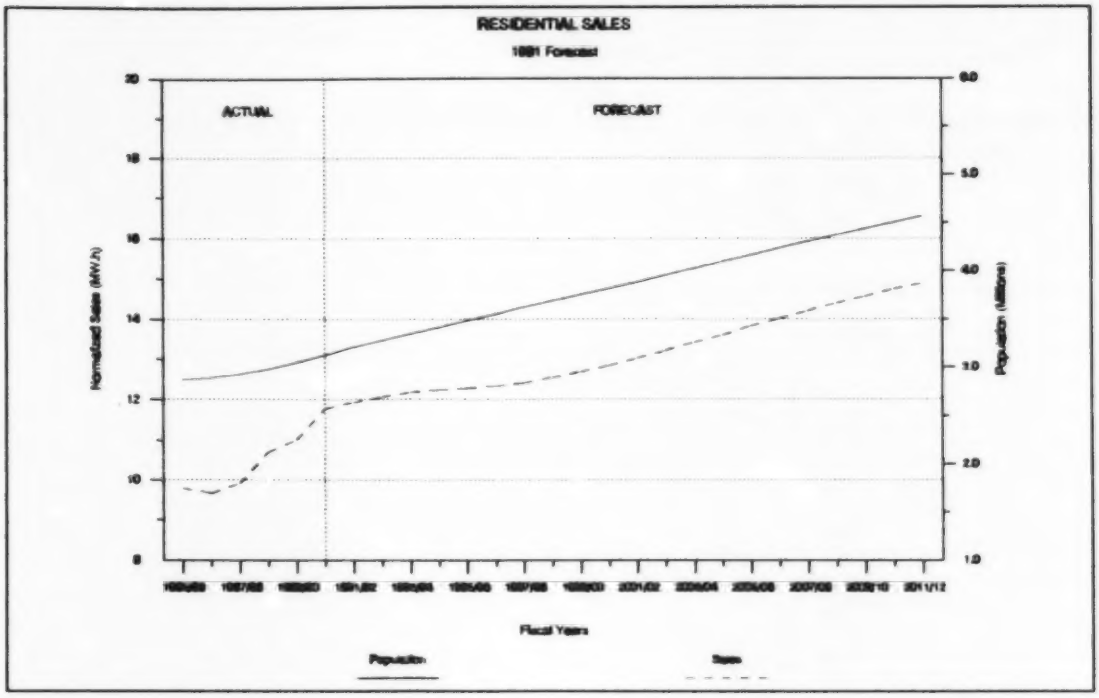
A residential end use model that incorporates DSM effects was used to analyze and forecast residential sector demands. The growth in use rate should continue to decline for another five years, and then start to gradually rise again as major appliances achieve maximum efficiency while the number of small appliances is projected to continue to increase.

	Year	Normalized Use Rate (kW.h/account)	Use Rate Growth	Average Annual Change In Rate Growth (kW·h)
Actual	1985/86	9,315		
	1986/87	9,667	352	
	1989/90	10,283		
	1990/91	10,435	152	-50
Forecast	1993/94	10,133		
	1994/95	9,975	-158	-78
	1997/98	9,498		
	1998/99	9,411	-87	+18
	2001/02	9,289		
	2002/03	9,257	-32	+14

(a) Number of Accounts

The Ministry of Finance and Corporate Relations projects population to grow at an average annual rate of 1.7% over the next 21 years.

The number of residential accounts is projected to grow at an average annual rate of 1.9% - approximately 26,000 additional accounts per year. The higher growth rate for number of accounts is due to the Ministry's projection of a decrease in the number of people per household from 2.55 in 1991 to 2.43 in 2012.



(b) Use Rate

Use rate is expected to stop growing and to start falling at an average annual rate of 0.8% over the forecast period. Use rate is expected to start dropping because of the combined impact of six trends:

- The number of people per account will continue declining over the forecast period.
- The B.C. housing stock will have an increased share of row houses and apartments, which are smaller and less electricity-intensive than typical single family dwellings.
- Major appliances will continue to become more electricity efficient.
- New homes will be better insulated, reducing electric space heating demands.
- The public's awareness of energy efficiency and public concern for the environment will continue to increase. These trends are expected to alter electricity consumption patterns.
- The new Vancouver Island gas pipeline will reduce the growth in electric space heating on the Island.

2.4 COMMERCIAL SALES

Commercial sales are projected to increase from 10,588 GW·h in 1990/91 to 14,281 GW·h in 2001/02, and to 17,116 GW·h by 2011/12 for an average annual growth rate of 2.8% and 2.3% for the two periods, respectively. Commercial sales account for about 25.9% of B.C. Hydro's domestic sales; this share is forecast to increase to 28.6% by 2011/12.

The commercial sector consists of five subsectors:

- Transportation, Communication, and other Utilities (T.C.U.)
- Wholesale and Retail Trade (Trade)
- Finance, Insurance, and Real Estate (F.I.R.E.)
- Community, Business, and Personal Services (Services)
- Public Administration (Government)

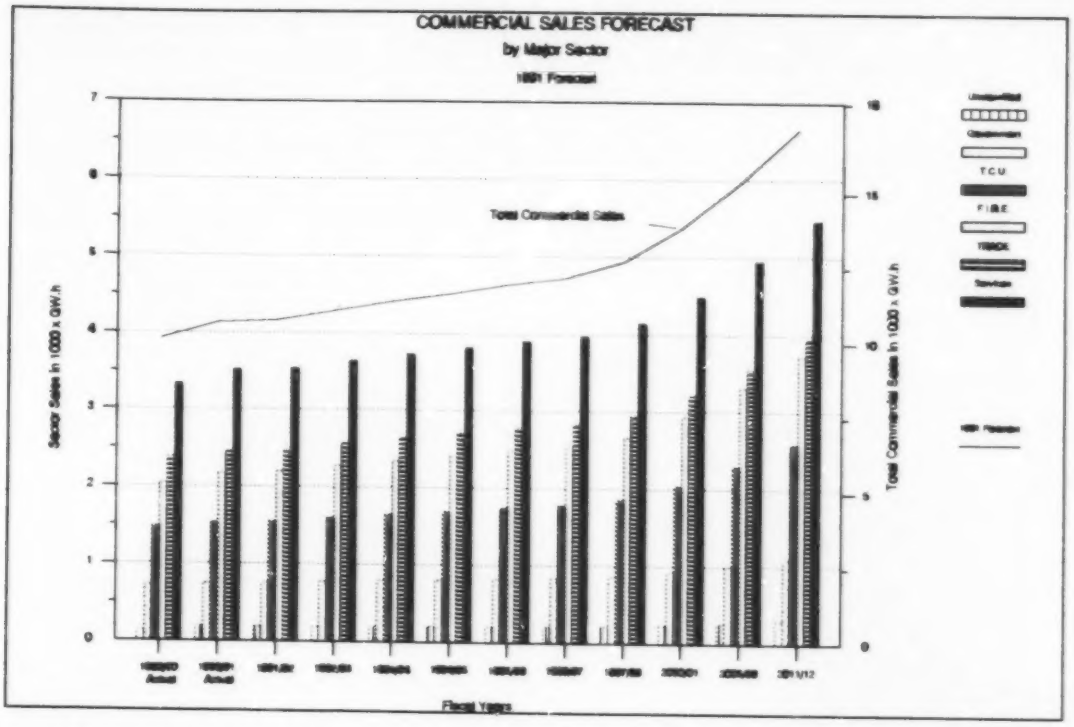
Any customers not included in these subsectors are grouped into one subsector called "Unclassified".

The amount of floor stock in the various subsectors is a key determinant of commercial electricity sales. Population and GDP forecasts are in turn the drivers of floor space estimates used to forecast commercial electricity sales.

Commercial sales were higher than expected for the fiscal year ending March 1991 as a result of higher than expected in-migration; more commercial activities were generated to support a larger population. Sales to this sector are forecast to continue to grow primarily because of increases in electricity intensity resulting from increased use of electronic and information technology. In the short-term, increased sales are forecast to the Service subsector to support a growing population. The Trade subsector is projected to have a relatively smaller increase because slower growth is forecast for the retail and wholesale trade. In the long-term, commercial electricity sales are forecast to grow more rapidly than both the residential and industrial sectors as a result of the continuing trend in B.C. towards a more serviced-based economy. Other factors which are expected to increase commercial sector sales are:

- a growth in tourism
- increased health care services for an aging population
- the continued growth of Vancouver as an international finance centre
- B.C.'s continued role as Canada's link with the fast-growing Far East markets.

Compared to the 1989 forecast, commercial sales are projected to grow at a slower rate mainly because of lower unit electricity requirements in new buildings, and because of the gradual retrofit of existing buildings with more energy efficient equipment.



(a) Transportation, Communication, and other Utilities

Sales to this subsector, which is composed mainly of transportation, grain elevators, radio and television broadcasting, and water and telephone systems, has been declining steadily for the past five years; from 15.3% of total commercial sales in 1986/87 to 14.4% in 1990/91. This subsector's share of total commercial sales is forecast to remain flat at its current level over the entire forecast period because the amount of coal shipped through the terminals will drop as the demand for coal is expected to decrease in the future and the proposed light rail transit expansions to Richmond and other suburban areas have been delayed as the result of increasing financial and social pressures.

Sales to this subsector grew from 1,326 GW·h in 1986/87 to 1,506 GW·h in 1990/91 (3.2% per year), and are expected to increase to 2,420 GW·h in 2011/12 (2.2% per year).

(b) Wholesale and Retail Trade

Total sales to the wholesale and retail trade sector were 2,453 GW·h in 1990/91, 3.2% more than in 1989/90. This is lower than the 4.8% growth recorded in the previous year. As the primary usage of electricity in this subsector is in electric motors and lighting, the smaller growth rate as compared to the past is consistent with efforts by this group to become more efficient in its electricity use.

The average consumption per customer grew at 4.3% per year from 62,700 kW.h in 1986/87 to 74,400 kW.h in 1990/91, and is forecast to reach 100,000 kW.h in 2011/12. This represents an average growth rate of 1.4% per year.

Total sales to this subsector are forecast to increase at a rate of 2.3% per year from 2,453 GW·h in 1990/91 to 3,950 GW·h in 2011/12.

(c) Finance, Insurance, and Real Estate

This subsector has grown steadily for the past five years; from 18.9% of total commercial sales in 1986/87 to 20.5% in 1990/91. Approximately 75% (about 1,600 GW·h in 1990/91) of sales in this subsector is to office buildings. The long-term outlook is for continued expansion of office space as trade and commerce with the Far East continue to grow. Also, recent changes to federal law are expected to encourage international shipping companies to establish offices in Canada; Vancouver is expected to attract a significant share of them. Average consumption trends continue to grow in this subsector despite continued energy efficiency improvements in office buildings. The full impact of improved efficiencies appears to be offset to some degree by continued increases in the use of electronic and information technology.

Total sales to this subsector are expected to grow from 2,173 GW·h in 1990/91 to 3,540 GW·h in 2011/12 for an annual average growth rate of 2.35%.

(d) Community, Business, and Personal Services

The services subsector is a very diverse group, consisting of establishments such as schools, hospitals, hotels, restaurants, and other personal services such as barber and beauty shops and religious organizations. This sector is forecast to have the highest growth because as the population increases, the number of service subsector establishments required will increase to meet growing demands for services. In addition, the demand on health components of the service sector will continue to grow as the population ages.

The addition of a new sub-atomic particle research centre at the University of B.C. is projected to require 300 GW·h each year starting in 1997/98.

Electricity sales to this subsector are expected to increase at a rate of 2.44% per year from 3,517 GW·h in 1990/91 to 5,820 GW·h in 2011/12.

(e) Public Administration

Government services from federal institutions such as correctional services to foreign government agencies are included in this sub-sector. This sub-sector is forecast to experience the slowest growth as governments restrict increases in expenditures in response to budget deficits.

Total sales to this subsector are expected to increase from 749 GW·h in 1990/91 to 1,089 GW·h in 2011/12 for an annual average growth rate of 1.8%.

(f) Unclassified

The unclassified subsector consists primarily of commercial establishments that have not been SIC (Standard Industrial Classification) coded, or they do not belong to the five major subsectors discussed above. There were about 6,100 customers in this subsector at the end of fiscal year 1990/91.

Total sales to this subsector are expected to grow from 189 GW·h in 1990/91 to 287 GW·h in 2011/12 for an annual average growth rate of 2.0%.

2.5 INDUSTRIAL SALES

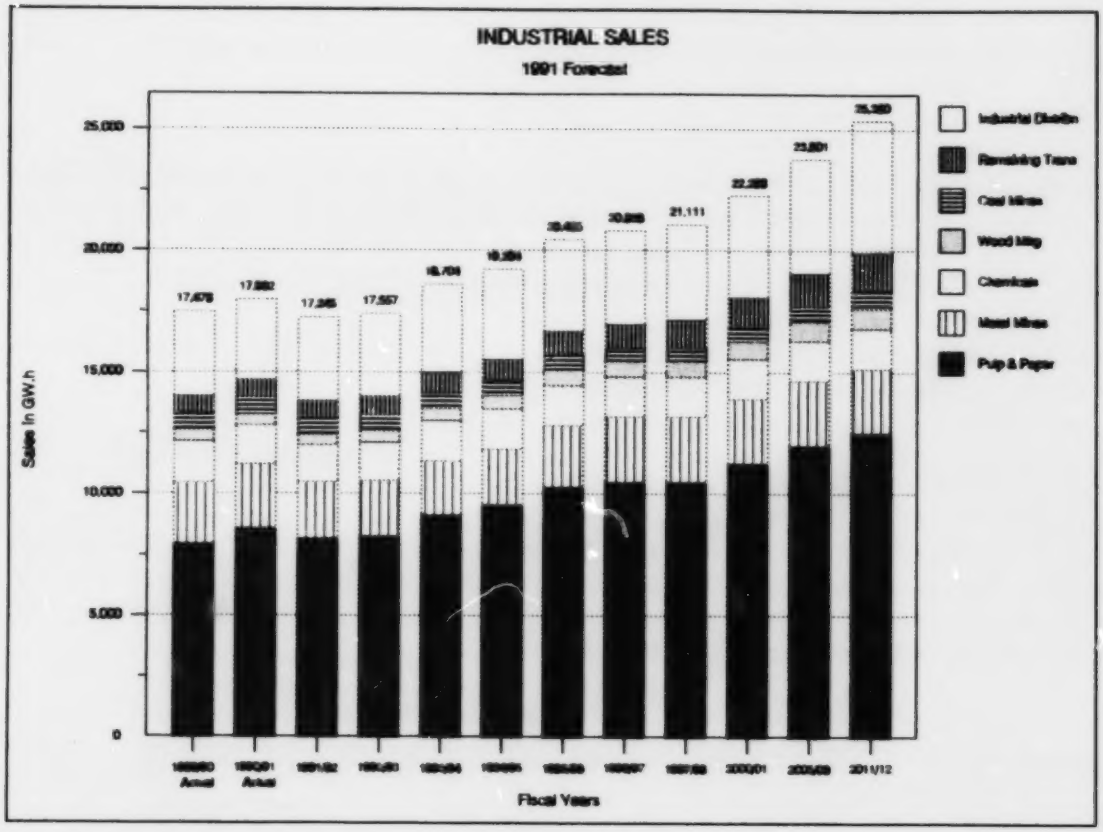
Total sales to the industrial sector are forecast to increase from 17,962 GW·h in 1990/91 to 20,465 by 1995/96; to 22,586 GW·h by 2001/02; and to 25,380 GW·h by 2011/12. These increases represent average annual growth rates of 2.6% (1990/91-1995/96), 2.1% (1990/91-2001/02), and 1.7% (1990/91-2011/12).

In 1990/91 B.C. Hydro sold 14,679 GW·h of electricity to its large industrial (transmission voltage) customers. Sales to these same customers are forecast to increase to 16,689 GW·h by 1995/96; to 18,273 GW·h by 2001/02; and to 19,927 GW·h by 2011/12. The remainder of industrial sector sales will be to the numerous, smaller industries on distribution voltage service.

Five subsectors of major importance to B.C. Hydro comprise the province's industrial sector:

- Paper and allied products
- Wood manufacturing
- Chemical and chemical manufacturing
- Metal mining
- Coal mining

In 1990/91, sales to customers in these five major subsectors comprised 95% of transmission rate sales, and 78% of total industrial sales. Sales to remaining transmission rate customers are combined under "Remaining Transmission Rate". Sales to other, miscellaneous industrial customers are combined under "Industrial Distribution Sales".



(a) Paper and Allied Products

All but one of British Columbia's major pulp and paper production facilities are serviced by B.C. Hydro. Sales to this subsector in 1990/91 were 8601 GW·h, or 59% of total industrial transmission sales. Although it is expected that industrial sector sales will continue to be dominated by the paper and allied products subsector, sales to B.C. pulp and paper mills are expected to decrease relative to 1990/91 levels in the short-term.

The current economic downturn has hit the B.C. pulp and paper industry very hard. In recent years, the industry has spent considerable amounts of capital in expanding capacity, and stricter environmental regulations necessitated additional capital expenditures on pollution control, on effluent treatment, and on other equipment which did not contribute to the bottom line. The world-wide economic slow-down coupled with excess production capacity have resulted in increased inventories and decreased prices. The combination of these factors has led many B.C. pulp and paper mills to significantly curtail production in 1991/92.

Growth in world demand for paper products has been forecast to continue throughout the forecast period. Therefore, after 1992/93, when the sluggishness

currently being experienced by many customer nations will have ended and the industry's over-capacity will have been absorbed, sales to the province's pulp and paper producers will again increase, surpassing 1990/91 sales figures.

The pace of expansion experienced by B.C.'s pulp and paper industry over the past few years is not expected to be repeated in the future. Competition in commodity grades from new mills in Brazil, Chile, and other areas is instead expected to force increased value-added production in B.C. Over the forecast period, expanded production of specialty grades and publication papers will increase electricity requirements per tonne of finished product.

Some expansion is forecast in electricity-intensive mechanical pulping as this process is very fibre-efficient, and is able to utilize previously untapped hardwood resources. A recently completed chemi-thermomechanical pulp (CTMP) mill is in the process of building up to capacity; an existing thermomechanical pulp (TMP) mill will approximately double its production after 1995; and a new pressurized groundwood mill and paper machine are forecast to begin operation in the North Interior region after 1995. Unlike chemical pulp mills, mechanical pulping facilities are not inherently suitable for cogeneration. Thus, increased subsector electricity demands resulting from expanded mechanical pulping capacity will not be offset to any significant degree by electricity self-generation/load displacement opportunities.

Two mechanical pulp mills will replace existing groundwood production lines with more electricity-intensive TMP and CTMP after 1993. The anticipated increase in annual electricity demand resulting from this replacement is estimated at 200 GW·h.

The addition of new equipment in response to increasingly stringent environmental regulations will also increase mill electricity demands. The addition of a secondary effluent treatment plant, for instance, may increase annual electricity demands by up to 30 GW·h for a large mill. The addition of an oxygen plant may add 20 to 35 GW·h per year, depending on output.

In response to solid waste management difficulties, many U.S. states have recently enacted legislation to ensure that newspapers sold within those states contain certain minimum amounts of recycled fibre. While some B.C. mills will lose U.S. market share as a result of not being able to meet the required recycled content, it is expected that those same mills will be able to market their product in Asian markets instead. Consequently, U.S. recycling legislation is not predicted to affect adversely B.C. newsprint production in the long-term.

In the short-term the recycling issue will impact on sales to this subsector, although to a relatively small extent. A new newspaper de-inking plant in the Lower Mainland began operations in late 1991, and is currently building up load to capacity. This plant will provide de-inked pulp to two major B.C. newsprint

manufacturers, allowing the latter to continue to sell to the U.S. market. A doubling of this facility's capacity is expected within the next three years. Another small paper recycling plant is forecast to begin operations in the Fraser Valley within five years. The combined impact of these two plants is an increase in sales of less than 150 GW·h per year.

Over the forecast period it is expected that this subsector's share of total industrial transmission sales will remain in the neighbourhood of 60%. Forecast sales to the paper and allied products subsector for fiscal years 1995/96, 2001/02, and 2011/12 are, respectively, 10,290, 11,250, and 12,500 GW·h.

(b) Wood Manufacturing

In 1990/91 sales to the 17 transmission voltage customers in this subsector totalled 473 GW·h, comprising 3.2% of total transmission voltage industrial sales.

A moderate increase in demand by this sector is forecast in response to post-recession increases in housing starts and home renovation activity, both in Canada and the U.S. Fibre constraints are expected to prevent B.C. producers from meeting the significant increase in market demand for softwood lumber expected over the forecast period.

A number of B.C. plywood mills have ceased operations in the past few years, and additional closures are forecast over the short-term. Within a few years, however, the increasing fibre constraints faced by B.C.'s competitors in the U.S. Pacific Northwest are expected to prevent further declines in B.C. plywood production; production will then remain stable for the remainder of the forecast period.

Most of the projected increase in this subsector's electricity demands over the forecast period will result from increased value-added manufacturing. A new fibreboard plant in the central interior will begin operating in 1993/94, producing a valuable building material from wood waste that is currently being incinerated as waste or land-filled. Market opportunities for a number of other additional plants - producing either fibreboard, particleboard, waferboard, or oriented strand board (OSB) - have been identified. New production facilities are therefore expected to be established gradually throughout the province, starting in 1996.

Other impacts of value-added manufacturing will affect those wood manufacturing firms on distribution voltage service. These impacts are discussed below under "Industrial Distribution Sales".

Annual sales to the wood manufacturing subsector are forecast to increase to 675 GW·h by 1995; to 750 GW·h by 2001/02; and to 850 GW·h by 2011/12.

(c) Chemical and Chemical Manufacturing

Nine transmission voltage chemical producers purchased 1600 GW·h in 1990/91, representing 11% of total industrial transmission voltage sales. Seven of the nine customers produced pulp bleaching chemicals; one plant produced methanol and ammonia; and the last produced specialty petrochemicals. The demands of this subsector are clearly tied to the demand of the province's pulp mills. A recovery in pulp and paper markets will not, however, result in increased sales to this subsector.

Increasingly stringent environmental regulations on water emissions of organochlorines have led to a large-scale replacement of chlorine-based bleaching in chemical pulp mills. This switch was responsible for the closure of one of B.C.'s two chor-alkali plants in late 1991. Substitution of chlorine dioxide (derived from sodium chlorate) for chlorine was found to reduce organochlorine emissions to acceptable levels, but pressure exists from some customers to produce a totally chlorine-free pulp. Consequently, the four B.C. sodium chlorate plants are unlikely to see expanded markets for their product. The remaining bleaching chemical plant produces hydrogen peroxide, which has been found to be an acceptable bleaching agent, and is being used in ever increasing amounts. Because of new peroxide production capacity in Alberta and the U.S. Pacific Northwest, significant expansion of B.C. peroxide capacity is not foreseen at this time.

Several pulp mills currently have or are installing chemical production capacity on site. Such production will further prevent any growth in electrochemical plant electricity demands.

The decline in sales to the province's electrochemical plants will be offset to some degree by an expansion in methanol and ammonia production after 1993, and by the establishment of a new aromatic compounds plant on the north coast after 1994.

The natural gas and oil fields in northeast B.C. produce the necessary feedstocks for petrochemical manufacture. However, significant increases in petrochemical production are precluded by Alberta's extensive, well-established petrochemical industry.

For the above reasons, sales to transmission voltage chemical producers are forecast to remain flat at 1650 GW·h throughout the forecast period. This subsector will account for 8% of total transmission voltage industrial sales in 2011/12.

(d) Metal Mining

The 10 major metal mines serviced by B.C. Hydro purchased 2581 GW·h in 1990/91, representing 18% of total industrial transmission sales. Eight of these mines produced copper, along with silver, gold and molybdenum as co-products. One mine produced predominantly molybdenum, and the last mine mainly gold.

Production from large, new mines in Chile and other developing nations and the general economic slow-down have depressed world metal prices. Consequently, during 1991/92 one south interior copper mine closed for the foreseeable future because metal prices were too low for its grade of ore to be mined profitably. Over the longer term, however, it is expected that world metal demand will increase, although at rates slower than historic. The political stability and excellent operating infrastructure in B.C. are expected to enable the remainder of the province's operating mines to continue to produce until their reserves are exhausted.

A second south interior copper mine closed in 1991 because its reserves have been exhausted. A north interior copper-silver mine, is also essentially played-out, and is expected to cease operations in 1992.

An existing polymetallic mine which had ceased operation in the mid-1980s is in the process of re-opening, and should be in full operation in 1992/93. An operating copper and gold mine on Vancouver Island will be coming onto the transmission grid during the 1993/94 fiscal year. These two increases do not, however, entirely offset the decreased sales demands resulting from mine closures. Consequently, a short-term drop of several hundred GW·h per year occurs until after 1994 when two new copper mines begin operating in the northern interior.

Over the longer term, metal mining demands are expected to plateau. Older mines will exhaust their reserves and shut down, while new mines will begin operating. After 1996/97, annual metal mining sales are forecast to stabilize at 2650 GW·h, equivalent to 18% of total industrial transmission voltage sales in 2011/12.

(e) Coal Mining

Seven coal mines are currently transmission voltage customers, two in the northeast of the province, the remainder in the southeast. Almost 90% of the coal mined in the province is metallurgical coal, destined for steel mills in the Pacific Rim. In 1990/91 these mines purchased 689 GW·h, or 5% of industrial transmission voltage sales.

Low coal prices and rising operating costs are currently hurting the province's coal mining industry. One southeast coal mine is expected to close in 1992/93

once its current contracts expire; a second southeast coal mine was recently sold; and a northeast coal mine is currently operating under court protection from creditors.

A gradual decline in B.C. coal mine output, and therefore in subsector electricity demand, is forecast over the next decade. Japanese steel makers - the major purchasers of B.C. metallurgical coal - are actively developing steel-making techniques which require significantly less coke (derived from coal). As well, increased production is expected from Australia, Canada's chief competitor in the Pacific Rim. In addition to making existing mines more productive, Australia is also in the process of developing three new mines. Other nations are also selling to the Pacific Rim; some, such as China and Indonesia, have clear transportation advantages relative to B.C. Such competition is expected to keep prices low, and B.C. mine costs relatively high.

Over the longer term, however, coal's prospects appear brighter. Developing nations are expected to require large amounts of thermal coal to fire power plants. In response to these needs, B.C. mine output is forecast to increase after 2000, although the increased production will be thermal coal, rather than metallurgical coal as in the past. An existing, small Vancouver Island thermal coal mine which is currently on distribution voltage is forecast to expand and become a transmission voltage customer after 1995, thereby offsetting some of the decline in coal mine electricity demands resulting from reduced metallurgical coal production.

After dropping from current levels to 500 GW·h in 1996/97, sales to the coal mining subsector will increase to 550 GW·h in 2001/02, and to 700 GW·h by 2011/12.

(f) Remaining Transmission Rate

Six petroleum refineries - four located in the Lower Mainland, and two in the northern interior - purchased 359 GW·h in 1990/91. The closure of a refinery at Taylor in 1991/92 is expected to be offset by renewed operations at a Port Moody refinery in the Lower Mainland.

Petroleum refining is forecast to be a no-growth industry. Slight decreases in refinery throughput in the immediate future will be offset by increased electricity demands for pollution control, for enhanced automation and computer control, and for the additional processing required to produce reformulated gasolines. Accordingly, annual refining demands are forecast to remain flat throughout the first half of the forecast period at 355 GW·h. Continued provincial population growth will result in a slight increase in refinery output after 2000, which in turn translates into total annual refinery electricity demands of 360 GW·h. The five remaining B.C. refineries will consume 1.8% of total industrial transmission sales in 2011/12, down from 2.6% in 1991/92.

In 1990/91, the province's three cement plants purchased 220 GW·h. One Lower Mainland plant is currently expanding its operations to export to the U.S.. This expansion will increase sales to this subsector to 265 GW·h by 1997/98. Sales are predicted to stabilize at this level for the remainder of the forecast period since additional export potential is unlikely, and the existing plants have sufficient capacity to meet the province's cement requirements.

New and existing transmission voltage manufacturing facilities in the Lower Mainland - such as the auto wheel rim plant in Delta which became a transmission voltage customer in the fall of 1991 - will result in increased sales of approximately 150 GW·h by 1995/96. These plants, combined with other existing and new facilities elsewhere in the province (such as a greenfield copper smelter on the North Coast), are projected to result in annual sales of 950 GW·h by 2011/12. This represents 5% of total transmission voltage industrial sales.

(g) Industrial Distribution Sales

Over 21,000 industrial distribution voltage customers were on B.C. Hydro's grid in 1990/91. Together these customers consumed 3,283 GW·h in 1990/91, which represented 18% of total B.C. Hydro industrial sector demand.

Steady growth is seen in the number of small industries in B.C. over the forecast period. This will translate into total industrial distribution demands of 3,776 GW·h in 1995/96, 4,213 GW·h in 2000/01, and 5,453 GW·h in 2011/12.

The largest distribution voltage subsector is wood manufacturing, numbering about 2,000 accounts, and accounting for roughly half of industrial distribution demands. Despite ongoing diversification of the province's small industries over the forecast period, it is expected that wood manufacturing will continue to consume approximately 50% of total industrial distribution voltage demands.

The increase in wood manufacturing demands is the result of a continued increase in value-added manufacturing. The effects of such an increase will be seen to a greater extent in the electricity demands of distribution voltage wood manufacturing customers than in those of transmission voltage customers. Sawmilling and planing - which occur at large, primary processing facilities - account for approximately 80% of the total electricity consumed by the wood products industry. Further (value-added) processing generally occurs at smaller facilities, these being distribution voltage customers.

Other significant subsectors represented only in the distribution voltage service group, along with their 1990/91 energy demands, are: food and beverage, with 1,250 customers purchasing 406 GW·h; fabricated metal, with 1,400 customers consuming 202 GW·h; forestry, with 1,100 customers using 126 GW·h; agriculture, with close to 3,000 customers purchasing 90 GW·h; and construction, with over 5,000 customers buying 202 GW·h.

2.6 OTHER SALES

Domestic inter-utility and out-of-province sales make less than 7% of total energy sales.

(a) Inter-utility Sales and Firm Exports

There are two domestic inter-utility customers, namely the City of New Westminster and West Kootenay Power. The latter serves customers in the south-central portion of the province.

(i) City of New Westminster

The City of New Westminster makes bulk purchases of energy, and supplies their customers with their own distribution system.

(ii) West Kootenay Power (WKP)

West Kootenay's capacity and energy purchases from B.C. Hydro are expected to increase with WKP's load growth. The 1986 Power Purchases Agreement between the two utilities required WKP to nominate both energy and capacity. The forecast reflects these nominations for the next five forecasting years.

The recently negotiated Principles of Agreement which would replace the 1986 Power Purchase Agreement between the two utilities would require WKP to nominate capacity on a five years basis and no nominations for energy. This Agreement will be subject to BCUC approval. One of the goals of the Principles is to assist in enabling WKP to build its own resources. This may result in a slower growth in WKP's purchases from B.C. Hydro in the long term.

(iii) Seattle City Light (SCL), Washington

These sales are made under the 1984 Skagit agreement. The agreement is in effect to the year 2065.

(iv) Point Roberts, Washington

Annual energy sales are forecast to approximately double from 1990/91 levels by 2011/12.

(v) Hyder, Alaska

Annual energy sales are forecast to remain constant over the forecast period.

(b) Short Term Out-of-Province Sales

Short term export sales are expected to the following customers:

(i) Alberta Power

Annual energy sales are forecast to grow by approximately 1 GW·h over 1990/91 levels by the year 2011/12.

(ii) Bonneville Power Administration (BPA), Washington

Short term firm sales to BPA.

(iii) Washington Water Power (WWP)

If the proposed interconnection between B.C. Hydro and WWP is not completed, then, according to a signed agreement, WWP has the right to purchase some firm capacity from 1995/96 to 2009/10. If the interconnection is completed, WWP will have the option to purchase a greater amount of firm capacity for 20 years.

(iv) Sacramento Municipal Utility District (SMUD), California

SMUD has signed a firm contract that starts in 1997 and runs for 25 years. The contract calls for 50 MW of firm capacity during summer months only, and for a specified amount of wheeling capacity.

SECTION 3.0 - FORECAST PROCESS AND METHODOLOGY

3.1 LOAD FORECAST PROCESS

The load forecast process consists of four major steps:

- the initiation of major inputs;
- the development of a reference forecast;
- the development of a most probable forecast; and
- management acceptance of the probable forecast.

The intent of the process is to generate a range of demand forecasts to reflect the outcome of different economic outlooks and uncertainties; to explore implications on resource, system and financial requirements; and to select a probable scenario for planning purposes.

All numbers in the document correspond to the Probable Forecast.

(a) Initiate Major Inputs

The gathering of information for updating the load forecast is an ongoing process. The following inputs form the base for preparing the 1991 long-term load forecast:

(i) Information for preparation of the population forecast is obtained mainly from the B.C. Ministry of Finance and Corporate Relations.

(ii) Input provided by outside consultants included:

- an outlook for the forest products industry prepared by the Strategic Services Division of H.A. Simons;
- a background paper on the chemical industry by Sandwell Inc.;
- an analysis of world demand for copper by Commodities Research Unit Limited, London;
- a report on B.C.'s coal mining industry prepared for the Ministry of Energy, Mines and Petroleum Resources of B.C. by Resources Management Services of Calgary;

- a study on world crude oil and North American natural gas prices by Confer Consulting Ltd. of Calgary.

(iii) A short-term B.C. Economic Forecast provided by the B.C. Ministry of Finance and Corporate Relations.

(iv) A short-term customer forecast prepared by each B.C. Hydro district office, including projections of residential and general customer additions for the next three years.

(v) A short-term customer plan supplied by B.C. Hydro's Transmission Customer Services. The latter department is in constant contact with the utility's large industrial and commercial (transmission voltage) customers. This plan is prepared on an individual customer basis, and forms the basis of the short-term industrial forecast.

(b) Development of a Reference Forecast

The population, economic, sectoral and energy price forecasts are translated into electricity requirements using a "top down/end use" approach to forecasting. The top down aspect of the approach uses population and economic forecasts and sectoral outlooks to project the rate of household formation, commercial activity and industrial production that generate electricity demands. The end use focus consists of analysis of present electricity use patterns, and of potential changes in those patterns in the future.

Refer to the Load Forecast Methodology section for details on how the Reference Forecast for each sector is developed.

(c) Development of a Probable Forecast

The effects of electricity price changes are examined by first establishing the scope customers have for changing electricity use.

Short and long-term electricity consumption elasticity factors were generated for the three customer groups: Residential, Commercial and Industrial.

An iterative process was employed to develop different electric pricing assumptions and to analyze customers' responses to electricity price changes. Impacts on resource acquisition were examined by the Resource Planning group; implications for revenue requirements were evaluated by the Financial Services group.

GDP forecasts were obtained from a number of external economic consultants in order to corroborate the internally-generated GDP forecast, and to determine a

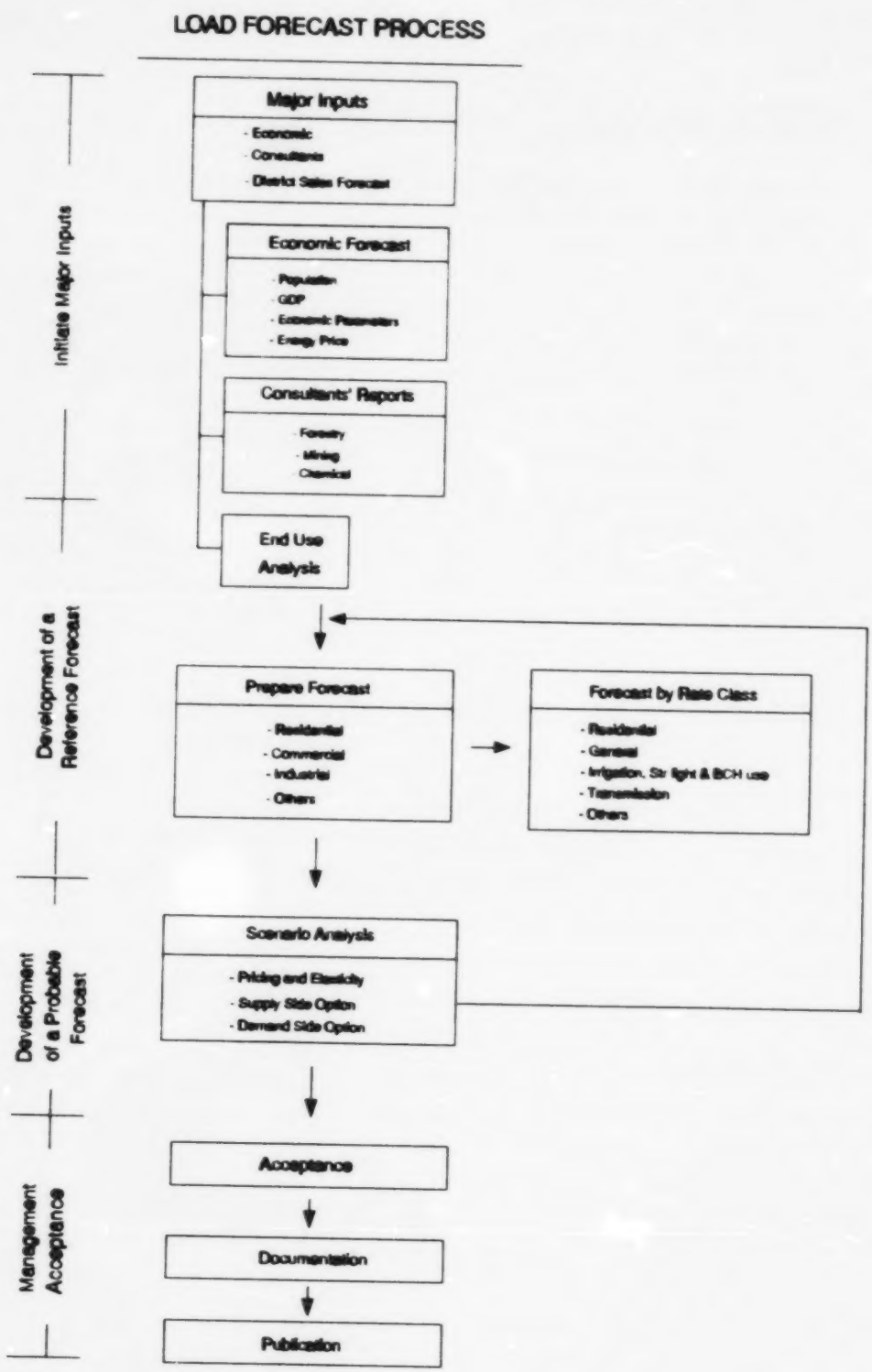
range of GDP values to use in the analysis of uncertainty in the B.C. Hydro forecast.

(d) Management Acceptance of the Probable Forecast

A range of demand forecasts is developed reflecting the outcome of different economic outlooks and uncertainties and is presented to senior management together with the recommendation of a Probable Forecast.

Senior management's acceptance of the Probable Forecast and the range of scenarios ensure a basis and flexibility to develop resource, system and financial plans to meet the most likely electricity demand requirements.

The probable energy forecast includes the development of short and long-term sales, energy, and peak requirements. Regional details by rate are developed for 11 years, and summary level projections are developed for 21 years for use in long-term planning. Also, monthly details for the next fiscal year are prepared for use in revenue forecasts.


LOAD FORECAST PROCESS
Initiate Major Inputs
Major Inputs
- Economic
- Consultants
- Distrib Sales Forecast
Economic Forecast
- Population
- GDP
- Economic Parameters
- Energy Price
Consultants' Reports
- Forestry
- Mining
- Chemical
End Use Analysis
Development of a Reference Forecast
Prepare Forecast
- Residential
- Commercial
- Industrial
- Others
Forecast by Rate Class
- Residential
- General
- Irrigation, St light & BCH use
- Transmission
- Others
Development of a Probable Forecast
Scenario Analysis
- Pricing and Elasticity
- Supply Side Option
- Demand Side Option
Management Acceptance
Acceptance
Documentation
Publication

3.2 LOAD FORECAST METHODOLOGY

(a) Residential

The residential forecast is developed with the use of two models - the cohort survival model and the residential model. Starting with demographic projections of fertility, mortality and migration, an age specific population forecast, for each of B.C. Hydro's operating divisions (regions) is developed using the cohort model. The provincial level results are compared and made to conform with the Ministry of Finance and Corporate Relations (MF&CR) population projection and the short-term customer forecast prepared by each B.C. Hydro region. The detailed results become one input to the residential model.

The residential model is an end-use stock model. Beginning with an age-specific regional population projection and using projections of headship rates and dwelling preferences, the model develops a regional housing stock for each year of the forecast. Based on a base year load profile for each dwelling type in each region, and on projections of usage trends for space heating, water heating, lighting and 10 major appliances, the model develops energy sales forecasts. Also included in the model are considerations of space heating fuel choices based on fuel prices, furnace efficiencies, and gas availability; demolitions, conversions, and retrofitting of housing stock; and penetrations and life cycles of various appliances.

REEPS, the Residential End-Use Energy Planning System, a computer model from EPRI, the Electric Power Research Institute, is run in parallel with the residential model to verify the residential forecast.

A procedure also exists for developing projections of short-term (three-year) account additions from operating personnel in the regional offices. Starting at the District level, Residential heating and non-heating (plus General under 35 kW and General, 35 kW and over) category customers are summated to the Division level. These numbers are compared to the results based on the long-term methodology, and, via consultations between Load Forecast and Divisional staff, short-term customer numbers are determined. The customer numbers become the basis for providing Divisional energy projections for distribution planning purposes.

The historical energy data essential to the forecast analysis are maintained. They are used in part for the weather normalization procedure which provides adjusted use data for the base year load profile.

(b) Commercial

The commercial forecast is developed from an analysis of the five main components (by Standard Industrial Classification - SIC):

- Transportation, Communication and Utilities
- Wholesale and Retail Trade
- Finance, Insurance and Real Estate
- Community, Business and Personal Services
- Public Administration

For each component the relationship between electricity use, GDP and population were established based on historical data. These relationships were then combined with projections of energy use rate, population and GDP growth, conservation trends, technological improvement and changes in lifestyle to obtain a projection of electricity use.

B.C. Hydro customers are coded by SIC, allowing load data to be analyzed and projected consistent with the categorization of the sectoral economic drivers.

COMMEND, the commercial-sector end-use planning system, a computer model from EPRI, the Electric Power Research Institute, is run in parallel with the econometric approach to verify the commercial forecast.

(c) Industrial

The industrial forecast is based on detailed analysis of each sector (SIC). For the areas of greatest significance - forest products, mining and the chemical industry - world market perspectives obtained from consultants were used as the basis of the longer term forecast. Production levels are analyzed in relation to provincial sectoral GDP forecasts. Patterns in energy intensity are considered in relation to technological change. Specific customer information is obtained and utilized to ensure consistency between the short-term projections and the macro industry outlook.

The forecast is prepared on a customer-specific basis for the large transmission rate accounts.

Use of specific key sector end use models is being pursued. With support from B.C. Hydro, researchers at the Natural Resources Management Program at Simon Fraser University have represented the province's pulp and paper industry on the Industrial Sector Technology Use Model (ISTUM). The results of ISTUM modelling runs were incorporated into the present forecast.

(d) Capacity

Total system peak is the sum of the peak of B.C. Hydro service area customers and the peak for firm inter-utility and export sales.

B.C. Hydro service area peak demand is the sum of the peak for distribution customers and the peak for transmission customers. Peak demand for distribution customers is calculated by adding distribution sales, associated distribution losses, and associated transmission losses, and using a load factor of 59.4%. Peak demand for transmission customers is calculated by adding transmission sales and transmission losses, and using a load factor of 80.0%.

Firm inter-utility capacity requirement for West Kootenay Power is based on their annual nomination. Based on historical experience, a diversity factor of 95% is assumed. Firm capacity requirement for Seattle City Light is based on the BCH - SCL agreement. Based on historical experience, a diversity factor of 70% is assumed. For all other inter-utility sales, if the sale agreement specifies capacity, the specified capacity is assumed. Otherwise the peak for the other utility is calculated by treating the other utility as a distribution or transmission customer, depending on the voltage level of the inter-connection. Diversity factors are only used when calculating capacity requirements for WKP and SCL.

3.3 DEMAND ELASTICITIES

The elasticity of electricity demand measures the response in the consumption of electricity to a change in variables that influence such demand.

Elasticity estimates for the B.C. Hydro system were derived from data from many sources including literature surveys; analysis based on B.C. Hydro consumption data; analyses/comparisons based on other B.C. data; and various U.S. analyses. All analysis was performed using a B.C. perspective to incorporate local factors such as climate, electricity price levels, etc. Relevant elasticity estimates were then generated. Both a point elasticity number and a range were selected for studying consumer response to electricity price changes.

OWN PRICE ELASTICITIES

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL	
	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run
Selected Range	0.17 to 0.35	0.45 to 0.80	0.15 to 0.40	0.49 to 0.83	0.06 to 0.13	0.20 to 0.45
Selected Value	0.20	0.65	0.15	0.65	0.05	0.35

The selected elasticity range, together with a range of values for three other variables (GDP, Consumer Price Index and Demand Side Management uncertainties) were used to develop a sensitivity band around the Probable Forecast.

The various studies referenced in the preparation of the elasticity estimates showed that the effects of own price elasticity were much more significant than those of cross-price elasticity. Consequently, cross-price elasticity was not examined in the preparation of this forecast when analyzing price response.

SECTION 4.0 - SENSITIVITY ANALYSIS

4.1 UNCERTAINTIES

There are two major components of uncertainty in the long-term load forecast:

- uncertainty in the future levels of major causal factors and their effect on future electricity consumption levels;
- uncertainty about how the relationships between the major causal factors and electricity consumption may change over time.

To reflect the overall uncertainties implicit in the load forecast, four major causal factors were used to analyze the sensitivity of the 1991 probable forecast: the long-term economic growth rate (reflected by GDP); the Consumer Price Index (representing inflation); the effective energy reduction achieved by Demand Side Management (DSM) programs; and the response to electricity price changes (price elasticity).

Three values (low, expected and high) were established to reflect possible future levels of each of the four causal factors.

Probability distributions were assigned to correspond to each of the three values of the respective causal factors.

An uncertainty model employing Monte Carlo simulation methods was used to quantify and combine the probability distributions; reflecting the relationships between the four causal factors and electricity consumption.

Refer to Appendix A for a detailed explanation of the Sensitivity Analysis.

A probability distribution was thus obtained which showed the various loads which could be expected from various combinations of the four factors.

The result of the analysis is shown in Table 2. For each year, the Gross Requirements Forecast is shown as a series of four values.

The low scenario:	There is a 10% chance the outcome will be below this value.
The Probable scenario:	It is most likely that the outcome will equal this value.
The Expected scenario:	This is the statistically determined average value of all the possible outcomes.
The high scenario:	There is a 10% chance that the outcome will exceed this value.

The probable demand scenario yields a total growth of 22,236 GW.h in total gross requirements, for an average annual growth rate of 1.9% over the 21-year period, 1990/91 to 2011/12. Correspondingly, the integrated system peak is forecast to grow from 8,401 MW in 1990/91 to 10,363 MW in 2001/02 and to 11,981 MW in 2011/12.

The expected demand scenario yields a total growth of 30,153 GW.h in total gross requirements, for an average annual growth rate of 2.4% over the 21-year period. Correspondingly, the integrated system peak is forecast to grow from 8,401 MW in 1990/91 to 11,030 MW in 2001/02 and to 13,386 MW in 2011/12. Compared to the probable scenario, the peaks are 667 MW higher in 2001/02, and 1,405 MW higher in 2011/12.

The low demand scenario yields a total growth of 19,317 GW.h in total gross requirements, for an average annual growth rate of 1.7% over the 21-year period. Correspondingly, the integrated system peak is forecast to grow from 8,401 MW in 1990/91 to 10,117 MW in 2001/02 and to 11,396 MW in 2011/12. Compared to the probable scenario, the peaks are 246 MW lower in 2001/02, and 585 MW lower in 2011/12.

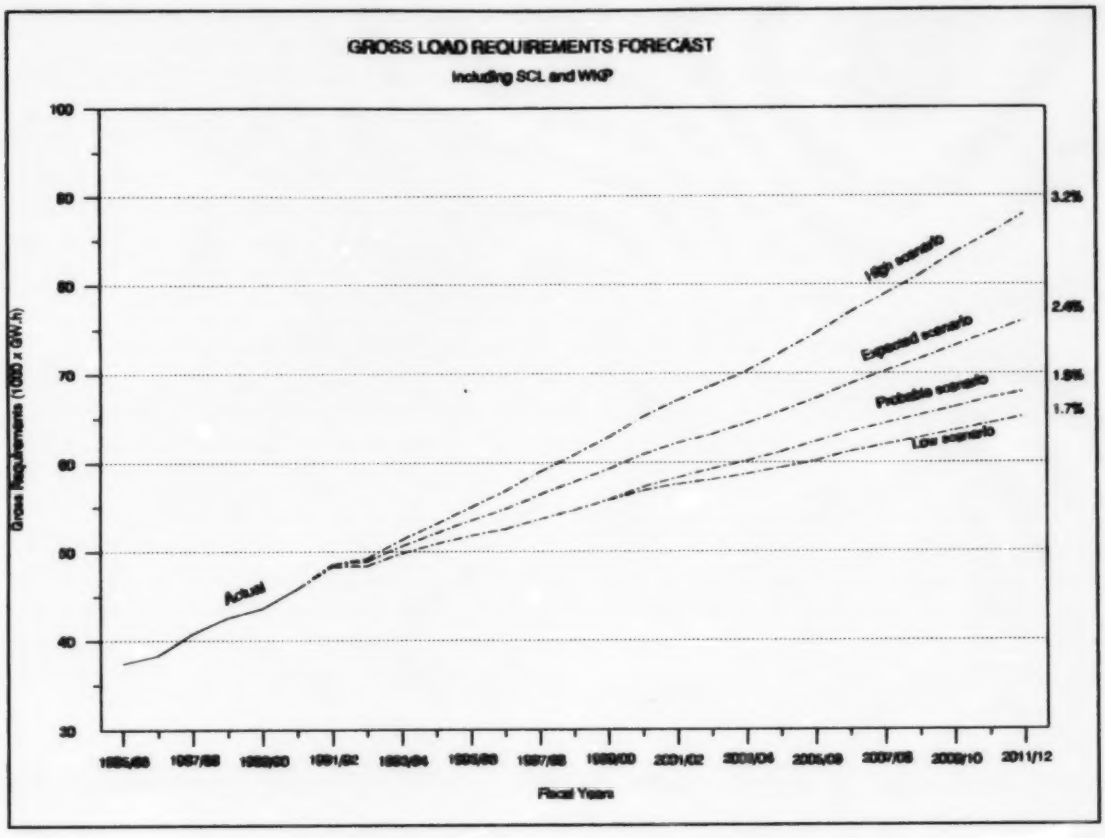
The high demand scenario yields a total growth of 42,122 GW.h in total gross requirements, for an average annual growth rate of 3.2% over the 21-year period. Correspondingly, the integrated system peak is forecast to grow from 8,401 MW in 1990/91 to 11,954 MW in 2001/02 and to 15,462 MW in 2011/12. Compared to the probable scenario, the peaks are 1,591 MW higher in 2001/02, and 3,481 MW higher in 2011/12.

TABLE 1
FORECASTS OF ELECTRICITY SALES TO B.C. HYDRO SERVICE AREA
(1991 Load Forecast)

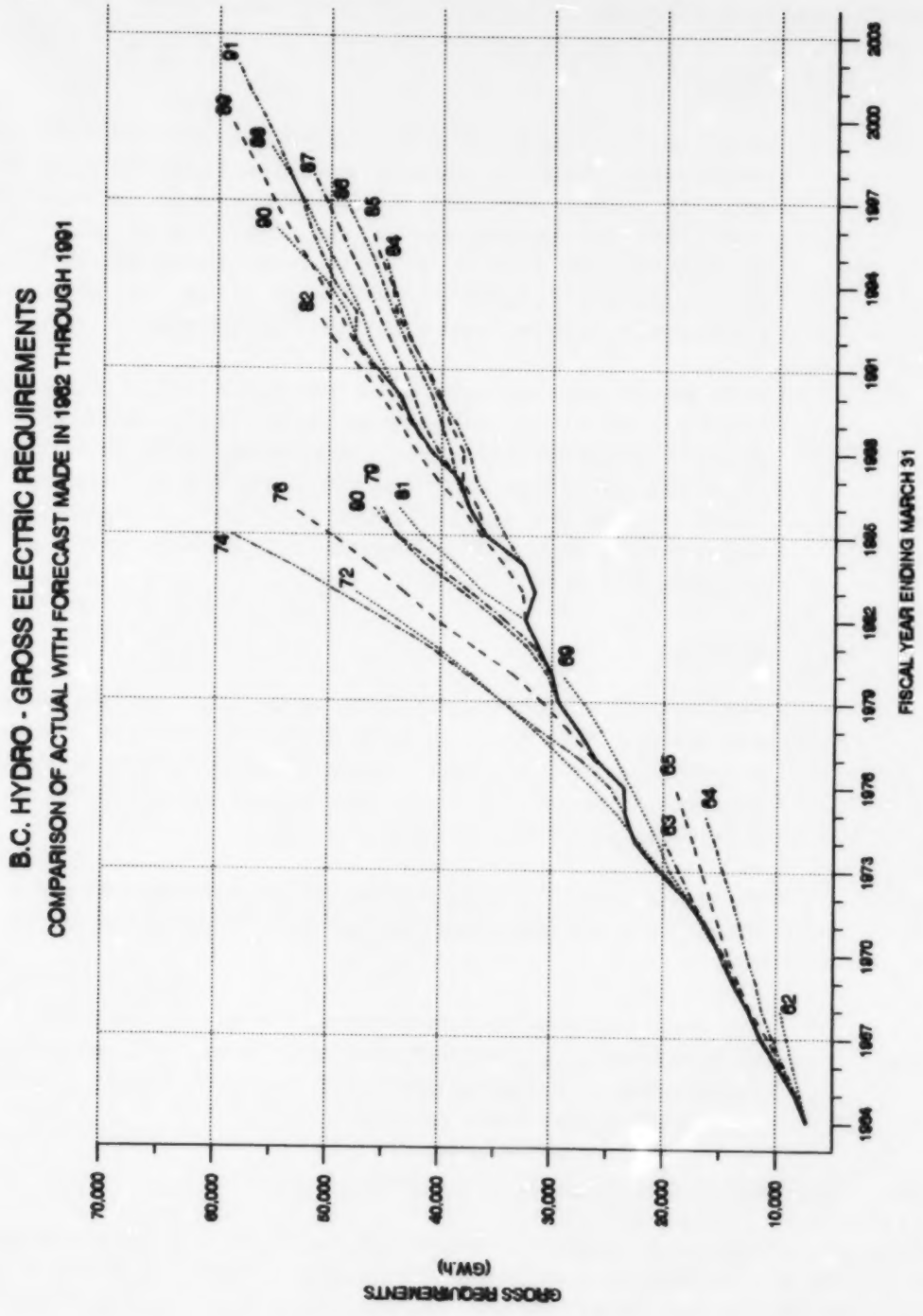
Fiscal Year	Low Forecast Sales (GW.h)	Probable Forecast Sales (GW.h)	Expected Forecast Sales (GW.h)	High Forecast Sales (GW.h)
1990/91 (Actual)	40,327	40,327	40,327	40,327
1991/92	40,094	40,094	40,347	40,347
1992/93	40,917	40,917	41,382	41,677
1993/94	42,318	42,318	43,070	43,668
1994/95	43,210	43,210	44,243	45,197
1995/96	44,670	44,670	46,195	47,485
1996/97	45,323	45,323	47,385	49,121
1997/98	46,233	46,233	48,724	51,021
1998/99	47,069	47,070	49,874	52,572
1999/00	47,961	47,984	51,037	54,247
2000/01	48,606	48,965	52,227	55,991
2001/02	49,162	49,881	53,280	57,539
11 Yr. Avg. Growth (%) (1990/91-2001/02)	1.8%	2.0%	2.6%	3.3%
2002/03	49,539	50,628	54,134	58,925
2003/04	50,065	51,394	55,137	60,334
2004/05	50,654	52,173	56,227	62,018
2005/06	51,069	52,978	57,312	63,728
2006/07	51,639	53,702	58,438	65,525
2007/08	52,306	54,421	59,582	67,310
2008/09	52,914	55,179	60,772	69,081
2009/10	53,554	55,902	61,984	71,301
2010/11	54,181	56,692	63,184	73,098
2011/12	54,772	57,366	64,414	75,063
10 Yr. Avg. Growth (%) (2001/02-2011/12)	1.1%	1.4%	1.9%	2.7%
21 Yr. Avg. Growth (%) (1990/91-2011/12)	1.5%	1.7%	2.3%	3.0%

TABLE 2
FORECASTS OF ELECTRIC GROSS LOAD REQUIREMENTS
TOTAL B.C. HYDRO (Includes WKP, SCL & Other Firm Exports)
(1991 Load Forecast)

Fiscal Year	Low Forecast Energy (GW.h)	Low Forecast Peak (MW)	Probable Forecast Energy (GW.h)	Probable Forecast Peak (MW)	Expected Forecast Energy (GW.h)	Expected Forecast Peak (MW)	High Forecast Energy (GW.h)	High Forecast Peak (MW)
1990/91 (Actual)	45,805	8,440	45,805	8,440	45,805	8,440	45,805	8,440
1991/92	48,295	8,519	48,295	8,519	48,579	8,555	48,579	8,555
1992/93	48,385	8,460	48,385	8,671	48,908	8,764	49,240	9,073
1993/94	49,817	8,731	49,817	8,896	50,662	9,045	51,335	9,369
1994/95	50,881	8,912	50,881	9,064	52,042	9,268	53,113	9,618
1995/96	51,793	9,069	51,793	9,176	53,505	9,478	54,954	9,909
1996/97	52,475	9,245	52,475	9,324	54,790	9,732	56,739	10,215
1997/98	53,604	9,486	53,604	9,520	56,401	10,010	58,979	10,518
1998/99	54,643	9,628	54,643	9,710	57,792	10,262	60,821	10,911
1999/00	55,801	9,782	55,827	9,904	59,254	10,505	62,858	11,245
2000/01	56,809	10,047	57,219	10,204	60,882	10,842	65,108	11,644
2001/02	57,525	10,161	58,333	10,407	62,149	11,074	66,932	11,998
11 yr. Avg. Growth (%) (1990/91-2001/02)	2.1%	1.7%	2.2%	1.9%	2.8%	2.5%	3.5%	3.3%
2002/03	58,031	10,255	59,254	10,575	63,191	11,261	68,571	12,247
2003/04	58,702	10,349	60,195	10,743	64,399	11,477	70,236	12,586
2004/05	59,447	10,558	61,152	10,916	65,707	11,711	72,211	12,958
2005/06	60,165	10,641	62,309	11,098	67,177	11,952	74,385	13,297
2006/07	61,173	10,802	63,490	11,261	68,811	12,199	76,773	13,647
2007/08	62,007	10,935	64,383	11,423	70,182	12,446	78,865	14,060
2008/09	62,777	11,117	65,322	11,593	71,607	12,701	80,943	14,416
2009/10	63,581	11,246	66,220	11,756	73,055	12,964	83,524	14,887
2010/11	64,373	11,305	67,196	11,880	74,491	13,172	85,633	15,204
2011/12	65,122	11,446	68,037	12,031	75,958	13,436	87,927	15,512
10 yr. Avg. Growth (%) (2001/02-2011/12)	1.3%	1.2%	1.6%	1.5%	2.0%	2.0%	2.8%	2.6%
21 yr. Avg. Growth (%) (1990/91-2011/12)	1.7%	1.5%	1.9%	1.7%	2.4%	2.2%	3.2%	2.9%


GROSS LOAD REQUIREMENTS FORECAST
Including SCL and WKP
Gross Requirements (1000 s GW.h)
100
90
80
70
60
50
40
30
Actual
High scenario
Expected scenario
Probable scenario
Low scenario
3.2%
2.4%
1.9%
1.7%
1995/96
1997/98
1999/00
2001/02
2003/04
2005/06
2007/08
2009/10
2011/12
Fiscal Years

4.2 COMPARISON OF HISTORICAL FORECASTS



4.3 TEMPERATURE AND ENERGY SENSITIVITY

(a) Temperature Sensitivity

(i) Winter

Winter peak can be calculated by using a load factor and total gross requirements. When the calculated peaks were compared to the actual peaks for recent years, and the differences were correlated with temperature, the analysis showed that every degree below minus 5.4 degrees Celsius added 60 MW to the peak. This sensitivity factor is based on peaks in the 6,000-8,000 MW range, and may have to be revised as the system continues to grow and peak demands rise.

In the past 10 years, there were five times when the annual peak occurred on a day colder than minus 5.4 degrees Celsius. The average of those five cold days was minus 8.54 degrees Celsius, implying that there is a 25% chance that cold temperatures will add 188 MW to the forecast. The coldest peak day over the past 10 years was minus 11.7 degrees Celsius, implying that there is a 90% chance that the cold temperatures will add less than 378 MW to the forecast.

(ii) Summer

Summer peak can also be calculated by using a load factor and total gross requirements. When those calculated peaks were compared to the actual summer peaks for recent years, and the differences were correlated with temperature, the analysis showed that every degree above 19.8 degrees Celsius added 52 MW to the peak.

An analysis similar to the winter one above showed that there is a 17% chance that warm temperatures will add 162 MW to the forecast summer peak.

For forecasting purposes, summer is defined as July and August. The adjacent months, July and September, could have higher peaks than the summer peak. This has happened before during a cold spell which led to an increase in space heating demand.

(b) Combined Temperature and Energy Sensitivity

If the high energy scenario is combined with the coldest peak day experienced in the last 10 years, the peak for 2001/02 could go as high as 12,332 MW, 1,969 higher than forecast, and the peak for 2011/12 could go as high as 15,840 MW, 3,859 MW higher than forecast.

If the low energy scenario is combined with warm temperatures, the peak for 2001/02 could go as low as 9,929 MW, 434 MW lower than forecast, and the peak for 2011/12 could go as low as 11,208 MW, 773 MW lower than forecast.

SECTION 5.0 - MARKETING AND POWER SMART

Three sets of programs are discussed in this section:

- Firm Industrial Marketing Programs
- Interruptible Marketing Programs (E+)
- Power Smart Programs

5.1 FIRM INDUSTRIAL MARKETING PROGRAMS

These programs were developed to market surplus electricity domestically and to allow domestic industries to be more competitive by providing them with reduced electricity rates.

Only one of these programs is still active, the Industrial Electricity Rate Discount Act - Bill 28 (Rate 1845). This program involves rates and sales volumes negotiated on an individual customer basis and for varying lengths of time. All existing contracts under this rate expire at the end of December 1994, and no sales under this rate are expected in following years.

5.2 INTERRUPTIBLE MARKETING PROGRAMS (E+)

The intent of these programs was to sell secondary energy at reduced rates for space and water heating purposes with the proviso that the service would be interruptible. Secondary energy is defined as the energy normally available on an annual basis between critical and normal water years on B.C. Hydro's system. Customers can be interrupted when adequate secondary energy is not available or for certain peak demand critical situations.

Surplus or additional energy is no longer available, so although sales are continuing through existing interruptible accounts, all these rates are now closed and no new interruptible accounts will be opened. Sales to all existing interruptible accounts are expected to remain at their 1990/91 levels.

5.3 TREATMENT OF POWER SMART PROGRAMS IN THE LOAD FORECAST

Power Smart is B.C. Hydro's name for demand side management programs. These programs refer to utility activities designed to reduce the utility's load. The reduction results from increased efficiency of energy use by the consumer, the increased efficiency having been induced by the utility.

The method used for incorporating Power Smart into the Load Forecast has been modified to reflect the maturing nature of the programs which have been in operation since 1989.

Power Smart programs are separated into two groups:

- Programs already in operation are included in the demand side and are reflected in changes in the end use profiles.

- Programs not yet in operation remain as resources.

Appendix E contains a list of all the programs included in the two groups.

As most Power Smart programs have been in operation for more than two years, it is becoming increasingly difficult to differentiate Power Smart impact from other behavioral and natural conservation impact in the end use load profiles. The lack of data on Power Smart's effect on the "status quo" of the load profile as well as changes in the "status quo" is a major consideration in changing the methodology for incorporating Power Smart estimates into the load forecast.

This approach addresses the concern that there is insufficient understanding of the behavioral aspect of electricity consumption - customer response to Power Smart programs versus electricity price changes, and conservation from Power Smart versus savings induced by other market and customer initiatives.

This change in methodology recognizes that uncertainties regarding behavioral response exist; that Power Smart programs already in place will have some lasting impact on consumption pattern; that projection of changes in usage pattern is based on observations on changes that have occurred; that changes in usage pattern that have occurred already include the impact of Power Smart programs already in operation.

This changes in methodology also acknowledges the long run impact of Power Smart programs already in operation.

B.C. Hydro is making efforts to quantify various behavioural aspect of electricity consumption. A Monitoring Program is in the process of being implemented to collect pertinent usage data over the next five years. The information will provide information on customer response to Power Smart, as well as on reaction rate changes, etc. The methodology for incorporating Power Smart into the demand forecast will be refined as better information becomes available.

GLOSSARY

Consumer Price Index (CPI)	- an inflation index calculated from comparing the price of a typical bundle of goods in the year in question to the price of the same goods in a set reference year.
Cogeneration	- the sequential production of electricity and useful thermal energy or shaft power from the same fuel source.
Demand Side Management (DSM)	- the influencing of energy demand to achieve socially economic improvements in the end use of electricity, and to shift electricity demand to reduce utility capacity costs.
District	- a sub-division of the B.C. Hydro service area. Four divisions exist: the Lower Mainland, Vancouver Island, the South Interior, and the North Interior. Divisions are further sub-divided into regions.
Distribution voltage customer	- refers to a B.C. Hydro customer who receives electricity via distribution lines which operate at relatively low voltage (34 kV and less) as compared with transmission lines.
Diversity	- that quality or characteristic by which individual maximum demands occur at different times. Diversity may be examined on an hourly, daily, monthly, or yearly basis.
Econometric modelling	- modelling which involves the use of statistical techniques, typically regression analysis of time-series and/or cross-sectional data, to detect statistically verifiable relationships, coherent with economic theory, between an explained variable (electricity consumption, for example) and explanatory variables (such as industry output, prices of alternative energy inputs, and GDP).

Elasticity	-	the proportionate change in a dependent variable, e.g. electricity consumption, divided by the proportionate change in a specified independent variable, e.g. electricity price. A dependent variable is highly elastic with respect to a given independent variable if the calculated elasticity is much greater than one; the dependent variable is inelastic if the elasticity is less than unity.
End-use model	-	a model used to analyze and forecast energy demand, which focuses on the end-uses or services provided by energy. Typical end-uses are lighting, process heat, and motor drive. For a given industry, such a model estimates the influence of prices and technological change on the evolution of the secondary energy inputs required to satisfy the industry's end-uses over time.
Gross Domestic Product (GDP)	-	a measure of the total flow of goods and services produced by the economy over a specified time period, normally a year or quarter. It is obtained by valuing outputs of goods and services at market prices (alternatively at factor cost), and then aggregating.
Gigawatt-hour (GW·h)	-	a measure of electrical energy, equivalent to one million kilowatt-hours.
Integrated system	-	that portion of the B.C. Hydro system which is connected as one whole. Non-integrated facilities refer to generating facilities which are not so connected, such as diesel-fired generating stations in remote areas of the province.
Monte Carlo method	-	a technique for estimating probabilities involving the construction of a model and the simulation of the outcome of an activity a large number of times. Random sampling techniques are used to generate a range of outcomes. Probabilities are estimated from an analysis of this range of outcomes.
Normalization	-	the correction of actual customer sales and peak demand for unusually warm or cold weather.

System Peak demand	-	the greatest combined demand of all B.C. Hydro customers faced by the generation system during a given fiscal year.
Price elasticity of demand	-	the percentage change in quantity demanded divided by the percentage change in price which caused the change in quantity demanded.
Real price increases	-	price increases that have been adjusted for changes in prices of all goods. The nominal price of an item may rise by 10% over a year, but inflation (and assumed wages) may have risen by 7% over the same time period. Therefore the effective price increase faced by the consumer is 3%. In other words, it is necessary to deflate current prices by an appropriate inflation index (the CPI in Canada) to convert money values to constant prices or real terms.
Region	-	a sub-division of B.C. Hydro's service area that is generally smaller than a Division. For instance, the Vancouver Island Division is sub-divided into the Victoria Region and the North Vancouver Island Region.
Transmission voltage customer	-	a B.C. Hydro customer which is supplied its electricity via high voltage transmission lines (60 kV or above). B.C. Hydro currently has 80 industrial transmission voltage customers (pulp and paper mills, for example) and nine large commercial transmission voltage customers (such as grain terminals).

APPENDIX A - METHODOLOGY USED TO PRODUCE THE UNCERTAINTY BAND

For each of the four major causal factors, a probability distribution was defined by three points: the minimum, the probable and the maximum. These points correspond to the low, probable and high of the respective causal factor.

1. LONG-TERM ECONOMIC GROWTH (GDP)

The long-term low, probable, and high economic growth scenarios used were annual GDP increases of 1.4%, 2.2%, and 2.9%. Generally, the uncertainty band for the annual growth rate in the short-term is likely to be larger than the uncertainty band for the average annual growth rate in the long-term. This is because models are generally better at predicting long run average values than in projecting short-term aberrations.

2. CONSUMER PRICE INDEX (INFLATION)

The long-term low, probable, and high Consumer Price Index increases used are 2.%, 4%, and 5% respectively.

The electricity price forecast is based on a fixed annual increase in the normal electricity price; the real price is the nominal price corrected for inflation.

When the GDP growth is equal to the probable value, it is assumed that the distribution of the inflation rate is given by the low, probable, and high inflation rates.

When the GDP growth is higher than the probable, the most likely inflation rate is linearly interpolated between the assumed probable and high inflation rate of 4% and 6%.

When the GDP growth is lower than the probable, the most likely inflation rate is linearly interpolated between the assumed probable and low inflation rates of 4% and 2%.

The linkage between the inflation rate and GDP growth is, therefore, handled by a change in the probable inflation rate. The high and the low bound on the inflation rate is assumed to be unaffected by the GDP growth rate.

3. EFFECTIVE ENERGY REDUCTION OF DEMAND SIDE MANAGEMENT (DSM) PROGRAMS

It is assumed that consumers would reduce electricity use when electricity price increases; that is, that energy saving measures would be installed without incentives from Demand Side Management (DSM) programs. The choice by consumers to opt for DSM programs when they would have undertaken those same DSM measures in the absence of these programs is referred to as the "free riders" effect.

The upper and lower bounds of the "free riders" effect are assumed to be 100% (total capture of all potential DSM) and 10% (90% of potential DSM would be implemented in the absence of Power Smart) respectively.

The probable value of the "free riders" effect is assumed to be 40% with inflation at 4%. This means that 40% capture of identified DSM potential would most likely occur. The probable value shifts towards the upper or the lower bound linearly, depending on whether the inflation rate is higher or lower than 4%.

4. RESPONSE TO ELECTRICITY PRICE CHANGES (ELASTICITY)

The elasticity of electricity demand measures the response in the consumption of electricity to changes in variables influencing such demand. However, estimates of elasticity are subject to considerable uncertainty. The probable value of price elasticities for the various sectors are estimated to be:

OWN PRICE ELASTICITIES

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL	
	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run
Selected Range	0.17 to 0.35	0.45 to 0.80	0.15 to 0.40	0.49 to 0.83	0.06 to 0.13	0.20 to 0.45
Selected Value	0.20	0.65	0.15	0.65	0.05	0.35

APPENDIX B - INPUTS TO THE FORECAST

The following details the major inputs and sources of information that drive the forecasts:

1. RESIDENTIAL

- Migration and total population forecasts are obtained from the Planning and Statistics Division of the B.C. Ministry of Finance and Corporate Relations (MF&CR).

- Historic fertility, mortality, migration, migrant age profile, and census data are obtained from Statistics Canada.

- B.C. Hydro accounts by dwelling type and by region are obtained from the Operation Supports Department in Western Integrated Technology Ltd.

- Demolition and conversion data come from the Field Service Order System maintained by the Market Planning and Evaluation Department.

- Four-year account projections are estimated by district office staff and cumulated by forecasting.

- Historical account and total energy use information is obtained from the Load Forecast Information System (LFIS) - adjusted statistics.

- Degree day statistics are obtained from the Marketing Division.

- Base year load profiles are developed using the Residential End-Use Survey - 1990 for appliance saturations and Energy Management data sheets specifying estimated consumption rates for appliances.

- Projections of trends in energy consumption for appliances come from B.C. Hydro's Residential Energy Management Department.

- Comparative information on appliance saturations and use trends are obtained from other utilities through the Canadian Electrical Association (CEA) and the Electric Power Research Institute (EPRI) in the U.S.

- Space heating capture rates are available from Field Service Order System.

- Furnace efficiencies are determined from information obtained from the Residential Energy Management Department.

- Energy price projections are developed with assistance from consultants.

2. COMMERCIAL

- Short term GDP projections come from the Ministry of Finance and Corporate Relations (MF&CR). Long term GDP projections are B.C. Hydro's estimates derived from data put together by a consensus.

- B.C. Population Forecast from the Ministry of Finance and Corporate Relations (MF&CR).

- Historical sales data are from LFIS and from the ICA System.

- Load profiles are developed from Commercial Energy Management data and from other utility data.

- Use patterns for various building types are obtained from a customer data base maintained by Commercial Energy Management.

- Forecast use trends are developed from specific application trends given by Commercial Energy Management.

3. INDUSTRIAL

- Key (electricity-intensive) industrial world and provincial outlooks are obtained from consultants.

- Historic consumption data come from the Industrial Consumption Analysis (ICA) System and the Customer Information Control System (CICS).

- Short-term projections (one to five years) are based on consultation with all major customers through B.C. Hydro's Transmission Customer Services Department.

- Energy use trends are obtained from research studies, consultant inputs and historical analysis.

- Reviews of the key sectors of the projections are solicited from provincial government agencies, consultants and other organizations.

APPENDIX C

B.C. HYDRO PROBABLE GROSS LOAD REQUIREMENTS BY MAJOR SECTORS
(Including SCL & WKP)

	Residen-tial (GW.h)	Commer-cial (GW.h)	Indus-trial (GW.h)	WKP (GW.h)	SCL (GW.h)	Other (GW.h)	Total Sales (GW.h)	Losses/ Accrual (GW.h)	TOTAL GROSS REQ'TS (GW.h)	Less Non-Integr. (GW.h)	INTEGR. SYSTEM TOTAL GROSS REQ'TS (GW.h)	INTEGR. SYSTEM PEAK (MW)
						(1)	(2)					
Actual												
1986/87	9665	8678	15365	16	320	286	34330	3971	38301	166	38135	6567
1987/88	9902	9061	16426	77	311	291	36068	4725	40793	165	40628	7060
1988/89	10700	9569	16713	109	312	312	37715	4897	42612	176	42436	7765
1989/90	11002	10090	17478	62	331	321	39284	4319	43603	172	43431	7513
1990/91	11783	10588	17962	289	306	338	41266	4539	45805	172	45633	8401
Forecast												
1991/92	11935	10914	17245	408	318	1988	42808	5487	48295	179	48116	8480
1992/93	12066	11294	17557	395	318	1228	42858	5527	48385	182	48203	8631
1993/94	12170	11444	18704	274	318	1238	44148	5669	49817	185	49632	8856
1994/95	12236	11690	19284	326	318	1249	45103	5778	50881	186	50695	9024
1995/96	12278	11927	20465	402	318	531	45921	5872	51793	186	51607	9136
1996/97	12330	12155	20838	488	318	396	46525	5950	52475	186	52289	9284
1997/98	12406	12716	21111	580	318	407	47538	6066	53604	187	53417	9479
1998/99	12532	13061	21477	652	318	420	48460	6184	54644	190	54454	9669
1999/00	12673	13438	21873	775	318	433	49510	6317	55827	193	55634	9861
2000/01	12830	13847	22288	1021	318	446	50750	6469	57219	197	57022	10162
2001/02	13015	14281	22586	1070	318	459	51729	6604	58333	201	58132	10363
Avg. Ann.% incr. 11 years:												
90/91-01/02	0.9%	2.8%	2.1%	12.6%	0.4%	2.8%	2.1%	3.5%	2.2%	1.4%	2.2%	1.9%
2002/03	13207	14536	22885	1121	318	474	52541	6713	59254	205	59049	10530
2003/04	13403	14801	23190	1171	318	488	53371	6824	60195	210	59985	10697
2004/05	13599	15075	23498	1222	318	503	54215	6938	61153	214	60939	10870
2005/06	13819	15358	23801	1429	318	516	55241	7068	62309	220	62089	11051
2006/07	14007	15636	24058	1743	318	529	56291	7199	63490	223	63267	11214
2007/08	14190	15922	24309	1795	318	542	57076	7308	64384	228	64156	11375
2008/09	14386	16225	24568	1847	318	556	57900	7422	65322	233	65089	11544
2009/10	14553	16520	24829	1899	318	570	58689	7531	66220	238	65982	11707
2010/11	14744	16848	25101	1951	318	584	59546	7650	67196	242	66954	11830
2011/12	14870	17116	25380	2003	318	599	60286	7751	68037	245	67792	11981
Avg. Ann.% incr. 10 years:												
01/02-11/12	1.3%	1.8%	1.2%	6.5%	0.0%	2.7%	1.5%	1.6%	1.6%	2.0%	1.5%	1.5%
Avg. Ann.% incr. 21 years:												
90/91-11/12	1.1%	2.3%	1.7%	9.7%	0.2%	2.8%	1.8%	2.6%	1.9%	1.7%	1.9%	1.7%

Notes:
1. Inter-Utility transfers (excluding WKP) and firm export (excluding SCL).
2. Interruptible Marketing (E+) and Demand Side Management (DSM) programs included in Actuals and in Forecast numbers.

APPENDIX D

B.C. HYDRO HISTORICAL AND PROBABLE ELECTRIC SALES FORECAST BY RATE CATEGORIES
(Billed Sales, No Adjustment for Accrual)

	Residential (GW.h)	-- General -- Under 35 kW (GW.h)	35 kW & Over (GW.h)	Trans. Rate (GW.h)	Irrigation (GW.h)	Street Light. (GW.h)	BCH Own Use (GW.h)	Firm Dom. Mktg. (GW.h)	Firm Exp. + Inter-Utility (GW.h)	TOTAL BILLED SALES (GW.h)
HISTORICAL									(a)	
1980/81	8,042	2,226	7,118	9,597	41	220	89		231	27,564
1981/82	8,640	2,328	7,378	9,339 (b)	41	224	98		260	28,308
1982/83	8,821	2,301	7,403	9,046	47	228	99		261	28,206
1983/84	9,005	2,251	7,578	9,074 (b)	49	226	85	190	262	28,720
1984/85	9,577	2,423	7,917	10,498	56	230	89	446	267	31,503
1985/86	9,793	2,494	8,343	10,650	68	238	89	1,013	452	33,140
1986/87	9,665	2,426	8,546	11,134	57	239	81	1,565	622	34,335
1987/88	9,902	2,590	8,927	11,994	76	241	79	1,580	680	36,069
1988/89	10,700	2,737	9,497	12,338	72	242	78	1,318	733	37,715
1989/90	11,002	2,835	9,950	13,375	58	241	68	1,041	714	39,284
1990/91	11,783	2,963	10,293	13,828	58	235	68	1,105	933	41,266
Avg. Ann.% incr. 10 years: 80/81-90/91	3.9%	2.9%	3.8%	3.7%	3.5%	0.7%	-2.7%		15.0%	4.1%
FORECAST										
1991/92	11,935	3,029	10,531	13,535	60	236	68	700	2,714	42,808
1992/93	12,066	3,127	10,778	13,882	60	236	68	700	1,941	42,858
1993/94	12,170	3,195	11,083	14,809	59	235	67	700	1,830	44,148
1994/95	12,236	3,270	11,336	15,486	58	233	66	525	1,893	45,103
1995/96	12,278	3,345	11,575	17,117	58	231	66		1,251	45,921
1996/97	12,330	3,416	11,821	17,399	59	231	66		1,202	46,524
1997/98	12,406	3,495	12,100	17,876	59	231	66		1,305	47,538
1998/99	12,532	3,595	12,427	18,162	59	229	66		1,390	48,460
1999/00	12,673	3,705	12,783	18,469	59	229	66		1,526	49,510
2000/01	12,830	3,823	13,167	18,789	59	230	67		1,785	50,750
2001/02	13,015	3,948	13,571	18,987	60	233	68		1,847	51,729
Avg. Ann.% incr. 11 years: 90/91-01/02	0.9%	2.6%	2.5%	2.9%	0.3%	-0.1%	0.0%		6.4%	2.1%

(a) "Firm Export & Inter-Utility" column includes: New Westminster, Point Roberts, Hyder, Out of Province (Alberta), Seattle City Light and WKP.
(b) Forest industry labour disruptions in 1981/82 and 1983/84 caused reductions in Transmission Rate sales.

APPENDIX E - LIST OF POWER SMART PROGRAMS

Included in the 1991 base load forecast is the impact of all Power Smart activities currently in place. Also implicitly included, as a change in end use intensities, are the future effects of the following programs:

1. Appliance Efficiency
2. Power Smart Water Heaters
3. Electric to Gas Water Heaters
4. Refrigerator Buy-Back
5. Domestic Water Heater Blankets
6. Residential Retrofit
7. Energy Efficient Lighting
8. Municipal Audits
9. Building Retrofit
10. Energy Management Controls

Not included are the future effects of the following programs:

1. High Efficiency Motor Rebate
2. Energy Efficient Pumps
3. High Efficiency Roadway Lighting
4. New Building Design
5. Natural Gas Fuel of Choice
6. New Plant Energy Assessment
7. Energy Efficient Fans
8. Bonus Partners

B.C. HYDRO
COMPARISON OF 1991 vs 1990 FORECAST
BY STANDARD INDUSTRIAL CLASSIFICATION (SIC)
(Billed Basis, No Adjustment for Accruals)
SALES in GW.h

	1991 PROBABLE FORECAST (2/92)							SEPTEMBER 1990 FORECAST						
	1990/91 (Actual)	1991/92	1992/93	1993/94	1994/95	1995/96	Growth (%) Avg 5 yrs	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Growth (%) Avg 5 yrs
RESIDENTIAL	**11,783**	**11,935**	**12,066**	**12,170**	**12,236**	**12,278**	**0.83%**	**11,384**	**11,685**	**12,013**	**12,326**	**12,657**	**12,988**	**2.67%**
COMMERCIAL - Total	**10,588**	**10,914**	**11,294**	**11,444**	**11,690**	**11,927**	**2.41%**	**10,489**	**10,820**	**11,210**	**11,609**	**12,016**	**12,433**	**3.46%**
Distribution	10,158	10,486	10,867	11,016	11,262	11,499	2.51%	10,065	10,391	10,781	11,170	11,577	11,989	3.56%
- T.C.U.	1,331	1,397	1,446	1,471	1,510	1,547	3.05%	1,365	1,425	1,485	1,542	1,608	1,675	4.18%
- Trade	2,453	2,537	2,634	2,669	2,718	2,771	2.47%	2,443	2,536	2,636	2,735	2,829	2,927	3.68%
- F.I.R.E.	2,173	2,244	2,330	2,365	2,423	2,482	2.69%	2,133	2,211	2,299	2,391	2,486	2,586	3.93%
- C.B.P.S.	3,303	3,387	3,507	3,552	3,635	3,708	2.34%	3,278	3,351	3,464	3,578	3,703	3,825	3.13%
- Public Admin.	709	728	750	757	770	782	1.98%	707	726	749	772	794	816	2.91%
- Unclassified	189	193	200	202	206	209	2.03%	139	142	148	152	157	160	2.85%
Transmission	430	428	427	428	428	428	-0.09%	424	429	429	439	439	444	0.93%
INDUSTRIAL - Total	**17,962**	**17,265**	**17,557**	**18,704**	**19,284**	**20,465**	**2.64%**	**17,890**	**18,641**	**18,825**	**19,509**	**20,672**	**21,865**	**4.09%**
Distribution	3,283	3,437	3,403	3,623	3,701	3,775	2.83%	3,558	3,636	3,733	3,838	3,941	4,044	2.59%
Transmission	14,679	13,808	14,154	15,081	15,583	16,690	2.60%	14,332	15,005	15,092	15,671	16,731	17,821	4.45%
- Metal Mines	2,581	2,300	2,260	2,195	2,250	2,500	-0.64%	2,625	2,577	2,417	2,372	2,477	2,582	-0.33%
- Coal Mines	689	630	620	610	610	610	-2.41%	662	675	675	680	690	720	1.69%
- Wood Manuf.	473	450	500	530	570	675	7.37%	482	540	587	622	649	674	6.94%
- Paper & Allied	8,601	8,180	8,429	9,231	9,618	10,290	3.65%	8,112	8,546	8,755	9,174	9,937	10,772	5.84%
- Chemical	1,600	1,493	1,550	1,650	1,650	1,650	0.62%	1,719	1,922	1,908	1,958	1,958	1,958	2.64%
- Remaining Trans.	735	755	795	865	885	965	5.60%	732	745	750	865	1,020	1,115	8.78%
TOTAL TR.& DIST.SALES	**40,333**	**40,094**	**40,917**	**42,318**	**43,210**	**44,670**	**2.06%**	**39,763**	**41,146**	**42,048**	**43,444**	**45,345**	**47,286**	**3.53%**
OTHERS														
- WKP	289	408	395	274	326	402	6.82%	124	360	265	257	384	578	36.05%
- SCL	306	318	318	318	318	318	0.77%	318	318	318	318	318	318	0.00%
- Inter Utility	317	321	331	341	351	362	2.69%	312	321	331	341	351	362	3.02%
- Out of Province firm	21	1667	897	897	898	169	51.75%	20	20	21	21	22	22	1.92%
TOTAL SALES	**41,266**	**42,808**	**42,858**	**44,148**	**45,103**	**45,921**	**2.16%**	**40,537**	**42,165**	**42,983**	**44,381**	**46,420**	**48,566**	**3.68%**

APPENDIX G - RECENT CHANGES IN CUSTOMER DEMANDS

Since the time that the forecast figures were finalized, new information has been obtained about the future demands of two industrial transmission voltage customers.

One Lower Mainland refinery is now expected to be mothballed within the next 12 to 18 months. Some portion of the refinery will remain in operation as a product distribution centre.

A Lower Mainland specialty petrochemical plant recently announced that it would cease operations at the end of March 1992. Poor economic conditions were cited as the reason for the closure.

The combined impact of these two closures is estimated to be 80 GW·h. This reduction represents a reduction in the annual sales of 0.46% of forecast 1992/93 industrial sector sales.